HUMAN DEVELOPMENT AND LEARNING

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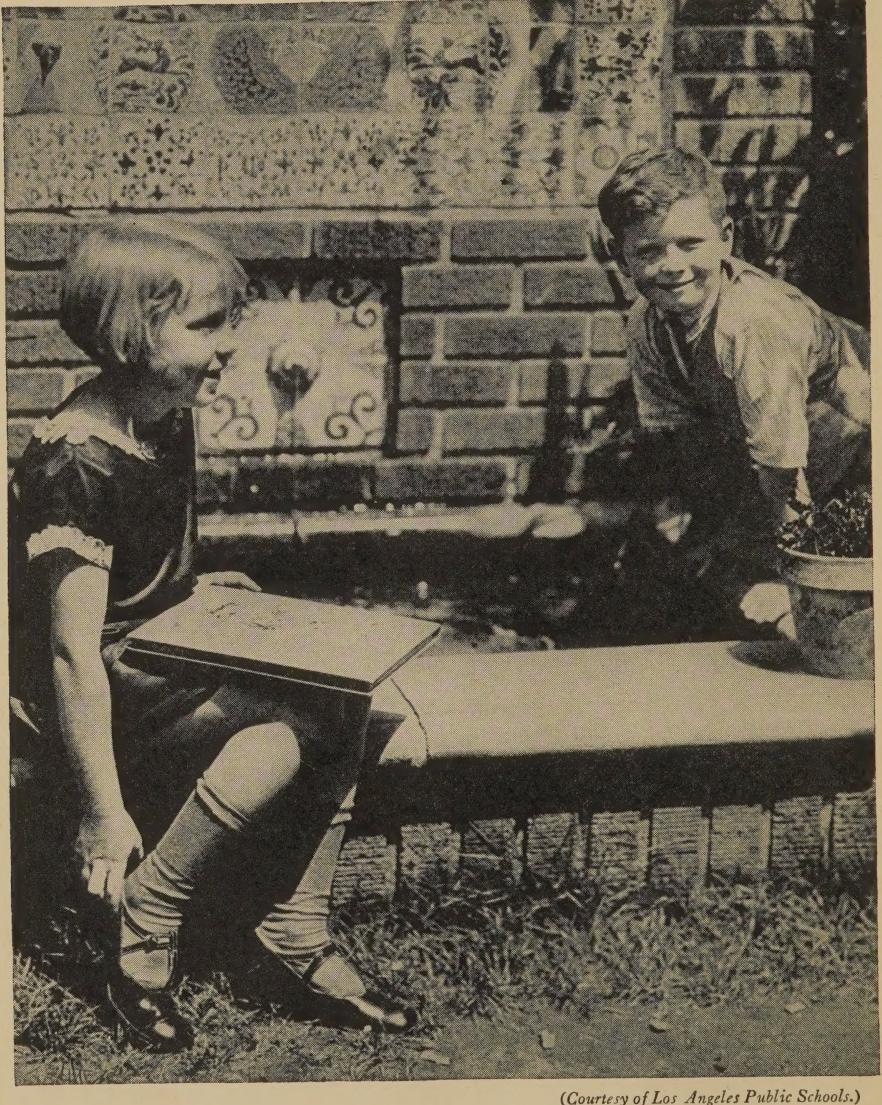

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(*Frontispiece.*)

Human Development and Learning

An Interpretive Introduction to Psychology

By

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Preface

The purpose of this book is to give the beginning student an interpretation of human nature that he can understand and use. In present-day psychology, and in other sciences, there is perhaps no tendency more significant than the way in which theory is related to practice. The man on the street is aware of this characteristic of modern science, and the beginning student of psychology enters upon his study expecting that his new knowledge will help him understand his personal problems and further his vocational ambitions. The beginning student in the field knows a good deal about human nature, he uses many psychological terms—with more or less accuracy—and he looks forward to more insight in his relations with fellow beings and with himself. Such expectancy is a stimulating challenge to this most human of sciences; it calls for a selection, an organization, and a well-grounded interpretation of a vast array of fact and theory, an interpretation that is intellectually satisfying and that can be put to work in the immediate affairs of life.

The author in accepting this challenge has been mindful of the current attempts to find common ground in the apparently conflicting schools of psychology, and he has felt free to select materials and place emphasis in ways that seem best suited to the practical purposes of this book. He has taken the position of interpreter, intent on

bridging the gap between common sense and scientific data, between theory and practice. Many areas of human relations are in need of clearer understanding of human nature; in no field is there greater need of psychological insight than in education. The day of training teachers with a bag of tricks is done; on the other hand, there is little to be expected from acquiring a mass of scientific data and principles, however convincing they appear in their scientific setting. We are well into an era in which nothing short of professional insight of a high order can meet the demands put upon those who are responsible for the education of children. Teachers, and likewise parents, should have an intelligent and sympathetic outlook on the whole range of childhood experience. A broad, well-knit knowledge of mental and social development is needed for understanding and dealing with the complexity of problems arising in daily relations with children and youth.

In the presentation that follows, issues have not been evaded, but controversy has been considered out of keeping with the need for clear understanding. Into the book have gone much that is old and much that is new. The basis for a unified study is found in the underlying processes of organic development; a study of the larger whole of developing life reveals the principles that throw light on the particulars. Man is more than a machine, and an organismic approach seems essential if his emotional and intellectual nature is to be comprehended in a way that will be useful. Such an approach seems well suited to making the most of both old and new in fact and theory; interpreted from this point of view, new light comes from the old, and the more recent contributions bear fruit by being put to work.

The book is an outgrowth of practical experience and the author is naturally indebted to many coworkers. Not the least of these are the supervising teachers of the training-school staffs of Ohio University and Illinois Normal

University, with whom the author faced at first hand the problem of the relation of psychology to new developments in education. Grateful acknowledgment is made to Dr. Lewis M. Terman and Dr. H. A. Brown for needed encouragement; to Dr. Robert H. Seashore and Dr. H. B. Wyman for critical reviews and suggestions; to Dr. Miriam Blanton Huber for valuable assistance in the preparation of the manuscript.

FRANK SEELY SALISBURY.

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Chapter One

Introduction

Psychology as a science is relatively new, but man has long pondered about the nature of human nature. The same thing is, to a degree, true of other sciences; their beginnings as sciences are relatively recent, but the problems that they face are very old. The roots of science reach back into ages that were anything but scientific; it has been a slow development from ignorance and superstition to speculation and casual observation, and thence to controlled observation and experimentation from which sound principles could arise and become guides to further understanding. In this development there has been more to satisfy than curiosity, for in the background there have always been practical implications and purposes to be served by new knowledge.

Practical Tendencies in Present-day Science.—Perhaps there is no aspect of present-day science that is more characteristic than the way in which the theoretical and the practical are related. We see the evidence of this in hundreds of research laboratories and experiment stations and in a varied program of research in universities and other educational organizations. These research agencies have become an accepted part of our life. We are expectant of new discoveries that are immediately practical or that will soon become practical. The professional worker is carefully educated for his service but must look forward to a con-

tinuous reorganization of his practice in the light of new discovery.

The results of this relation of the theoretical and the practical affect our lives at every hand. Isolation of vitamins leads to new diet regulations. Research in plant physiology unites with research in the chemistry of soils to guide intelligent crop rotations. Steam turbines, gas engines, and electrical equipment undergo continuous development as understanding of the principles of mechanics and of energy transformations is put to use. A change in our thinking concerning the nature of mental processes opens the way to the development of psychological clinics and to a more enlightened adjustment of personality problems of both children and adults.

Many Practical Uses for Psychology.—This practical turn of modern science is undoubtedly reflected in the attitude of the beginner in the study of psychology. We find ourselves or our friends doing inexplicable things and look forward to the study of psychology to clear up these matters. Many modern novels require an understanding of psychology to make them fully intelligible. You may recall your college entrance tests and hope to learn something of how such tests may be used for the guidance of people in choosing careers. Perhaps you have had tests of musical ability and would like to learn how valuable these may be for predicting success in this field. There are innumerable avenues through which this fast-developing science touches our lives, and it is right that we should look forward to a study which will yield many practical results.

The beginner in psychology should be warned that sound theory is very practical and that theory is a good check upon practice, just as practical application may be a good check upon theory. The more recent history of psychology indicates that the road to knowledge in this field is long and difficult. The world is dotted with psychological laboratories, and innumerable workers are trying to find the truth about human nature. Many things have already been

learned, but much remains to be discovered. The record of the past includes many attempted short cuts to truth, and many times the explanations have resulted in a too simple interpretation. Conflicts have arisen between various schools of thought, and there have been times when the beginner, intent on trying to learn something of human nature to satisfy his practical needs, has come from his initial study in a state of confusion.

Some Fields and Major Problems in Psychology.—A first look at the field of psychology of the present day may give the impression of confusion, but the student should take courage from the efforts that are being made to unify and use the best from various schools of thought. There is evidence of much success in the search for a way to get the most out of both the old and the new in psychology.

Another characteristic of present-day psychology that may at first be confusing to the beginner is that there are so many different fields. In addition to *general psychology* there are many particular psychologies such as *animal*, *physiological*, *educational*, *individual*, *child*, and *abnormal*. To this list may be added special-problem fields to which many individuals have given a lifetime of research. Examples of such special-problem fields are the measurement of intelligence and attitudes, the analysis and adjustment of personality difficulties, the education of the deaf and blind, the problems of adolescence, the study of gifted children, and the development of guidance techniques. All this gives evidence of the possible scope and value of the study of human nature.

There are not only many fields of psychology and special problems of psychological research but many areas of practical life in which workers are making a specialized application of their knowledge of human nature. The art of the window dresser is based on a knowledge of human response to color and form. The advertisement writer couches his words and illustrations in ways that presuppose that he knows how they will affect the reader. The news writer and

editor do much the same thing. We are living in a world of propaganda of one kind and another which makes use of knowledge of psychology. So potent is this new force that we must school ourselves against the possibility of being exploited by it, and this protection again implies a knowledge of our own nature. Politics and political organization, salesmanship, management, and all the varied areas in which people deal with other people open avenues in which a better understanding of human nature can and does yield returns.

Psychology in Education.—One of the areas in which psychology has been put to work is the field of education. So much has already been done that a special field of educational psychology has become recognized. The related field of child psychology is added evidence of the importance of accurate knowledge about child development and the way children learn. At home and school, growing youngsters present such complexity of problems to parents and teachers that the best available knowledge still falls short of the need. At the present time home life and school life are undergoing rapid changes which lessen restraint of parents and teachers and give more and more responsibility to youth. Strictly scientific psychology has had too little to do with these rapid developments, but there are great need and great opportunities for psychology to make valuable contribution to this important movement.

Author and Reader Look Ahead.—The preceding discussions have served their purpose if they have given something of a common ground upon which the author and the reader may meet to look ahead and lay plans for what is to follow. First, to what kind of psychology shall we look forward? The answer to this lies in the kind of book this is intended to be, namely, a beginner's book for students who wish an understanding of psychology as it applies in the school and the home. The present text is based for the most part on three fields of psychology—general, child, and educational. It is intended that the needs of the beginning

student shall dominate the study, that the materials presented be helpful to him in understanding human nature.

Facts Must Be Interpreted.—The materials for this book have been drawn from two general sources, everyday experience and scientific data. Both types of materials must be interpreted to be understandable and useful. We shall not be satisfied with presenting masses of scientific materials; the knowledge gained must be useful; therefore in selecting and organizing the materials pure science is not put foremost. Although the emphasis will be upon useful interpretation, this does not mean that we shall not be scientific, nor does the prominent place given to the interpretation of everyday experience mean that we shall not give full recognition to sound principles and theory. It simply means that we shall try to bridge the gap between the results of scientific discovery and the practical use to which they may be put in everyday affairs. We shall find our materials where we may; we shall prize them highly if they are experimental in nature and scientific, since real understanding cannot be superficial. We shall value those materials most highly, however, which throw light upon the main problem that we have before us, namely: How do human beings develop and learn?

In entering upon such a venture the student's own good judgment of the value of this type of study may be fortified by the following statement made in the preface of a critical book on the psychology of learning:

> During recent years there has been much activity in the field of psychology. New movements are appearing, and old beliefs are undergoing criticism and revision. In spite of the fact that psychology prides itself on being a science, its deepest problems are of a kind that cannot be solved by the application of scientific technique. These are problems of interpretation.[1]

It is proposed that our study shall be interpretive, and this seems to call for an organization that will permit us to

[1] Bode, B. H., *Conflicting Psychologies of Learning*, D. C. Heath & Company, 1929.

start with the things we know and widen and deepen our understanding as we proceed. The student would not be concerned about the study of human nature if he did not already know something about it, and the problem is how best to proceed from a very general knowledge to a more comprehensive insight that will continue to be of use in everyday life. When the student has made some progress, he may perhaps sense the need of logically organizing what he knows; under such circumstances he should get much good from his effort to be logical.

It is easy for the beginner to become lost in a maze of particulars, and this is not in keeping with our purpose of useful interpretation. The student is urged, therefore, to enter upon his study with the resolve that what he learns shall be his, his to use in everyday affairs. It has been the intent of the author to lay a sound basis for bringing the particulars into an understandable unity. We start with our general knowledge as we find it and raise this knowledge to a higher order of insight and usefulness through studying particulars. The study of each particular is a study of some phase of the whole, and our general knowledge should not only rise to a higher order of understanding but become organized into a more firmly knit whole that will be useful in everyday life. To this end the author has ordered the story in this text, and to this end the reader is invited to enter upon his study with a resolve to keep his knowledge and insight well knit and useful.

The Importance of Approach.—In beginning a study we are on more secure ground if we know the way in which we are to approach our problem and the methods we shall use to gain fuller understanding. Some people choose to study human behavior as though human beings were machines. Those who approach the problem in this way say that we should analyze the machine, find its parts, discover the minute units that go to make the machine, and see how these parts may be added one to the other to make the machine work. But when one tries to explain the human organism on

such a basis, too many differences are found to make the parallel fully satisfying. The human body is its own power plant. It does its own repairing and keeps its parts in working relation. Indeed, not only can the human organism replace parts within reasonable limits, but it has come to be the kind of machine it is through a growth and development from within, rather than by being created according to a plan with which it has nothing to do. Without the aid of the living organism itself one could not put the human machine together, nor could one repair a broken part. Machines are organized from without, to do a particular kind of work, whereas human beings are in their very natures an inner organization. Instead of doing one thing, human beings do many things, and they have an extensive capacity for adapting to new situations that they confront. Unlike machines they respond to situations in varied ways, and they learn to improve their responses to situations.

A more useful approach to the problem of human behavior, the organismic, centers the study of behavior on how it is organized. From this approach the questions asked are: How does the organism develop? What can it do? How is it organized to behave as it does? This approach holds to the belief that the best way to come to an understanding of an organism is to study its activity as a whole and to study the ways in which its activity is organized and patterned. In our study we shall concern ourselves with the particulars of the human organism, but this will be for the purpose of understanding how parts work together to account for behavior. We may at times ask *why* we are a living organism, *why* behavior continues and varies with the needs of the organism, *why* all this disappears when life ends; but generally we shall be asking *how* regulation and bodily control take place, *how* are these activities organized and patterned into purposive growth and purposeful behavior?

The Study of Developments.—The past may mean what occurred but a minute before or may refer to something that happened last week; either event may be looked upon as the

beginning of what we do now. Today's behavior may go back to even more remote influences, such as the advice given by a teacher or friend in years past. The use that is made of such advice may depend upon the kind of home in which we were reared and upon our inheritance from our parents. What we did long ago may have a persistent influence upon our behavior. Some of these influences have their beginnings before birth in the inherited capacities that are a part of our very nature. One way to understand an event of any kind, whether it be an incident in the life of a human being or an occurrence in inanimate nature, is to study the circumstances that have led up to it and brought it about. In government, for example, a new policy has a background in events that have gone before, and we have a better understanding of the policy when we see it in its historical setting. Another example of a problem that needs perspective to solve it arises when sea shells are unexpectedly found upon mountaintops. One may at first wonder who could have brought them from the seashore and why he should have done so. Then when one is told that this mountaintop was once the bed of a great sea and the rising of the earth's crust has brought it to this altitude, one understands the situation; the presence of sea shells on mountaintops becomes not only reasonable but significant because it is seen in relation to a great geological drama.

Similarly, when one goes about the study of a living organism, one will, before he is finished, want to study how the organism came to be what it now is. To understand how a plant lives one may study its structure under the microscope and discover the nature of the various tissues and the way in which they are arranged and how they are related to one another. One may also study how the parts work together in maintaining relations with environment. All this takes on added meaning, however, when one has studied how the tissues developed from a seed and how the seed came into being. New meaning comes from seeing the life process in its beginning and in the course of its development. In going back to beginnings and following the course

of developments, the details are found in simpler stages and the whole life process seems less complex and the reasons for the changes that take place are more easily understood.

Patterns within the Larger Whole May Be Studied.—In studying human behavior it is difficult to keep in mind at all times the whole of life. We therefore do our observing and thinking by attending first to one aspect of behavior, then another. The human being is organized so that such observation is possible, for though the different parts of the body are interdependent yet they have a great deal of independence, both in their structure and in their behavior. Thus, there are the patterns of behavior that seem to be prime essentials to mere living, such as breathing, eating, the digestive processes, the circulation of the blood, and other activities that go on without much attention on our part as long as no unusual circumstances of life are confronted. Such activities are called *autonomic*. There are other activities which seem to take care of themselves but which occur only when they are set into action by some particular circumstance in the environment, as, for example, the contraction and expansion of the pupil of the eye to regulate the amount of light that is admitted to the retina. This activity is called the *pupillary reflex*. There are many other reflexes which act more or less independently, such as the adjustment of the lenses of the eyes to bring the image of objects into focus upon the retina, the movement of the eyeball to bring the image to fall upon the most sensitive spot of the retina, the holding of the eyes fixed once they have been brought into the best position for seeing an object, the turning of the head to hear sounds better, the turning away when we smell foul odors, the spitting out of bad-tasting food, and the pulling of the hand away from hot objects that it chances to touch or from pins that stick the fingers. A few of these reflexes are ready to function at birth, and others develop soon after.

Behavior on Many Levels.—There are other relatively independent activities which come naturally in the course of development but which are more complex than the reflexes.

The sucking of the babe, the development of the ability to walk and to speak, playing with dolls, the manipulation of objects held in the hand, and the behaviors that manifest interest in other people—these and many other behaviors of like nature have been called *instinctive*. There is so much difference in the way psychologists use the term *instinct* that one needs to study carefully this type of behavior before one comes to any final conclusions about it. For the present we may say in a very general way that most human beings who grow up under normal conditions behave in somewhat the same way in activities such as have been mentioned above. But the way in which individuals work out the particulars of such a behavior as playing with blocks, for example, varies greatly. The circumstances under which they engage in these activities vary so greatly that, to some degree at least, each is called upon to exercise his ability to adapt intelligently. The ability to adapt to things that are unusual is what the term *intelligence* means. Everyday life is filled with such examples of adjustment to the new and novel in life. Instinctive behaviors are so varied and so related to larger units of behavior that it becomes difficult to tell what should be called *instinctive* and what should be called *intelligent* behavior.

In the chapters that follow we shall want to reconsider these various levels of behavior—autonomic, reflex, instinctive, and intelligent. For the present it is enough to note that they offer one way of studying human nature, making it possible to consider one phase or aspect of the larger complexity, and thus make our problem easier. These levels of behavior, with all their interdependence, are parts of larger wholes; they could not exist unless they were part of the total behavior of the organism; they are significant only because they are so related.

New Understanding through Studying Other Organisms. Many times understanding comes when we find a way to stand off and see ourselves in relation to other organisms. The truth is too near us at times to be seen; the more

fundamental things are difficult to discern because they are so commonplace. The study of the behavior of lower animals gives needed perspective and helps in the discovery of fundamentals. Thus we shall later study the simple one-celled ameba because in this simple organism the essential principles that underlie the activities of life are clearly evident. At another time we may find it advisable to study birds as they nest and rear their young in order that we may see the limitations of instinctive behavior. We shall find it profitable, also, to study experiments that have been conducted with goldfish, chimpanzees, and other animals to see how behavior and learning vary when the conditions surrounding the animal are varied.

Observation, Experimentation, and Generalization.—We can and do learn much about human behavior simply by observing what goes on in our own lives and in the lives of others. We are all experimentalists to some degree, asking questions in order to try out our ideas with other people or trying to help the baby walk to see if his natural growth processes cannot be speeded up. To be sure, the conditions under which we conduct these casual experiments of every-day life are not carefully controlled, but through them we add definitely to what we learn from our more casual observations of events that "just happen." Experimentation generally sets out to determine whether a hypothesis is true or false. The experimenter is open-minded, but he controls the conditions that affect the behavior of the subject, the one on whom he experiments, so as to try out his hypothesis. He records his observations carefully, so that when the experiment is done he can make reasonable interpretations of what has happened and possibly set up a new hypothesis for further experimentation. Naturally, what one experiment reveals is compared with the results of general observation and other experiments. When these comparisons result in essential agreement, with the facts all pointing to much the same conclusion, we may make a *generalization*, that is, we may state all that has been

learned in a way that gets at the meat of the matter. A generalization may be of such significance to further study that it may be formulated into a *principle*, which may become the basis for the interpretation of new data.

The General Plan of the Book.—It would be well for the student to read through the "Contents" of the book to get a general idea of the plan of the development. After this introductory chapter there follows one that takes us to the everyday life of a typical American family so that we may become more fully aware of the main problems which we face in our study. In Chaps. III, IV, and V, the basis is laid for interpreting human nature by a study of the development of the human embryo and the organic principles that become the basis on which the higher orders of behavior are interpreted. Chapter VI, "Emotional Behavior," joins naturally in this sequence to give a fuller understanding of the source of the dynamic characteristics of behavior.

The remainder of the book may be divided into two parts. Chapters VII to XII are concerned with the learning processes and the intelligent and conscious behavior that distinguishes man so markedly from other species. The last part of the book, including Chaps. XIII to XIX, is concerned more definitely with the study of human beings as different individuals. The bases for these differences in heredity are considered, then the techniques of dealing with these differences, and some of the uses to which these techniques have been put in attempting to gain a better understanding of human beings. Social development with its accompanying problem of emotional control leads into a study of personality and personality problems, and thus to a consideration of esthetic and creative experience. The book ends with a short chapter which summarizes the main outline of the study and points to some of the larger implications that seem to grow out of the interpretations which have gone before.

Practical Helps for the Student.—In order that you, the student, may keep your study closely related to your own experience and to the everyday living of people, it is sug-

gested that you make a "Psychology Notebook." Perhaps another name for the notebook will be preferred, such as "Human Beings as We Find Them," or "Movies of Life," "Life Patterns," or "Patterns in the Making." If individual notebooks do not seem desirable, then the class may wish to carry out the plan, perhaps through a bulletin board.

You may have snapshots which mean much because you took them and know the circumstances that they portray. It will be surprising how many of these will find a fitting place in your notebook as you proceed with your study. You can undoubtedly sense the worth of many a picture long before you find just where you may wish to use it. You may want to use the same illustration more than once. At times you may find your own drawings more appropriate than any other illustration. Keep an envelope in which you collect such materials for future use.

Rotogravures and other illustrations of daily papers and news magazines are filled with the doings of human beings. Cartoons and comic strips with significant meaning may be found, and the advertising sections of magazines are sometimes fruitful in illustration.

These portrayals of life's drama carry a challenge to your ability to interpret their significance. Choose a sentence or two to accompany each illustration, or write a pointed caption or brief comment to suit the purpose to which you wish to put the illustration.

One may well ask: Why use pictures when the realities of life may be observed on every hand? Direct observations should indeed be made. Illustrations represent the observations of other people. They are selected, however, to tell a story; in other words they are not merely observations but also interpretations. The truth is that we must learn what to look for as we observe; we must develop a sense of what is significant. We must learn not only how to observe but also how to interpret what we see before us.

To the growing record of illustrations you should add a diary of your observations. You may observe children of different ages from day to day and from week to week in

order to get a firsthand basis for studying the nature of human development. Observations may well be made by two or more students together. What one does not see the other may, and it will always be profitable to compare a given interpretation with that of other observers. The whole class may at times be able to make observations that can become the basis of class discussion and further observations. Possibly members of the group may take snapshots that will be valuable. If equipment is available, you may even wish to venture into the making of a reel of motion pictures. Other cooperative work may be initiated by small groups or by the whole class to bring together evidence on particular phases of human behavior. Materials might be selected from the notebooks of many individuals to make a product to represent the whole class. Such enterprises may become of such merit that surveys of them deserve to be presented to groups in the community, such as woman's and service clubs.

At the end of each chapter definite suggestions will be made for the development of your notebook. There you will find suggestions for further reading and at times suggestions for the diary of your daily observations and experimentations. Notes from reading and brief records of experimentations should find a place in the notebook. You and the group of students with whom you work may write your own psychology in picture and brief comment. The record will grow out of your experience and you will find a growth in your ability to understand what you see about you.

Summary: We Look Forward to the Study of Human Nature.—In the preceding discussion it is assumed that the purposes of the student in entering upon his study of psychology are essentially practical. This point of view is fortified by our survey of the practical origins of science and by the intimate relation between research and life of the present day. Science is the servant of mankind, and it is thoroughly in keeping with the spirit of scientific procedure that we study psychology for practical purposes. The

student is therefore urged to look forward to a study of human nature that starts with everyday experience and progresses toward a higher level of practical understanding and insight.

With this point of view and method of study in mind, the student is urged to enter actively upon his adventure into new understanding of himself and his fellow beings. As he goes about his usual affairs of life let him make use of what he learns. Let him join with fellow students in the collection and organization of news items, illustrations, snapshots, records of observations, and simple experiments. Let the student search for further understanding in additional reading, in discussion in class and out, so that his adventure into the study of human nature may be well unified as he proceeds.

SUGGESTIONS FOR NOTEBOOK AND BULLETIN BOARD

1. Bring together a picture display that will indicate various fields of psychological investigation.
2. Make another display that shows the wide use to which psychology is put.
3. Develop a set of illustrations showing the avenue through which we learn about human nature, including casual observation, observation to verify a hypothesis, experimentation, interpretation, and formulation of principles or laws.

SUGGESTED READING

1. The problem of method of approach is of ancient origin, as the reader will find on reading the first part (pp. 36–42) of Chap. 3 of Hopkins, L. T., *Integration.* D. Appleton-Century Company, Inc., 1937.
2. The more experienced readers will be interested in a review by Allport, G. W., "The Personalistic Psychology of William Stern," *Character and Education*, Vol. 5, pp. 231–246, 1937, which gives an interesting perspective on the problem of combining "common sense" and science in an interpretation of human nature.

Chapter Two

We Live and Learn

The purpose of this chapter is to examine the everyday affairs of a typical family in order that we may take stock of what we already know of human development and at the same time bring more clearly to light the general nature of the problems that are to be faced in our study. Much of the time life is so very close to us that we do not see it plainly. Intent on living we do not observe how we live; intent on growing we do not concern ourselves with how we develop. We live in close relations with friends and neighbors, but our interest in them does not lead to careful observation and to a critical search for how they came to be what they are. It is therefore our intention to study human behavior by approaching it directly, taking it as we find it.

We Look In upon the Nelson Family.—In a spirit of wholesome inquiry let us go to the Nelson home at the close of the day. Mother and the baby have been at home all day. Father left in the early morning and will be back about five-thirty from his work as foreman in the roundhouse. Jimmie, twelve years old, will be home about the same time after a day of school and play, and Jane, who is in the first grade, is already at home. Here we have the typical American family, living the usual life of father and mother and growing children, with the usual routine of work, rest, and a little play for adults and the usual school and more play for children. Jimmie has taken a bit of responsibility by selling

a weekly magazine. He is given to big talk about getting a job some day. He wants to be an engineer and drive one of the big moguls his dad and the men at the roundhouse get ready for their run. Jane in her small quiet way is very much the sensible young lady, helping her mother, admonishing Jimmie to do this and that, and carrying the issues of real life into her play with her dolls. The baby is little concerned with family problems; in his two years he has not gained the insight necessary to make him aware of them, but without knowing it he too cannot but take to himself something of the tempo and coloring of his surroundings.

Life Moves On.—With the Nelsons as with other families, this closing day finds life moving on, quite like many other days in the general way in which one succeeds another, but different always from those that have gone before. Adults and children finish the day, set for taking up life tomorrow where they leave it at bedtime today. The baby makes no plans, but he is always up and doing early. Jane puts her dolls to bed with talk of the busy day ahead. Jimmie, on many a Friday night, has hung his clothes in an ingenious arrangement to clip seconds off the time of dressing for an adventurous Saturday. Father and mother make something of a rite of the peaceful half hour after the children have gone to bed, reviewing little incidents of the day, with sometimes a backward look and then one forward into the future.

The whole family life and the life of each member are fraught with this sense of the "carry" and "go" of life. What the members of this family do and what they are on a given day can be seen and understood only in relation to what has gone before and in relation to surrounding circumstances of the life of which they are a part. The momentum of events carries today into tomorrow. The years, months, weeks, days, and hours flow together into a continuous stream, with the experience of the moment the latest addition to the forward march of the whole of life. The persistent

force of this continuity of life is astounding. The outside world of people and things changes in its meaning for each individual with his added experience of each day. Personalities develop and change with the meeting of new situations.

Social Relations in Life.—The Nelson children learn very early that outside the family circle there is the great wide world. Jimmie is beginning to realize what it means to belong to some of the larger social groups outside the home. Jane's vision does not reach so far as Jimmie's, and the baby takes life as it comes, with small regard for anything that does not serve his immediate personal needs. With each passing day, however, the children project themselves more definitely into widening spheres of relations. Jimmie dreams of being an engineer some day, and the wide world into which the big engines go calls strongly to him. Like the life within the family circle, there is much in this larger life that holds them to something of the same general pattern of behavior. The social relations of one individual with another, in the family, in the work and play with neighbor children, and in contacts with the life of the community, gradually make each individual one with the stream of life and bring him finally into a living relation with the civilization of his time. Gradually the personalities of the children take on something of the color and fiber of the social groups of which they are a part; gradually they project themselves into wider currents through the new purposes and goals that they set for themselves. This common background of social life, added to their common biological inheritance, stamps the lives of the children more or less with family characteristics.

Born Individuals, Children Become More Individualistic. There are, however, many influences at work that make children decidedly different individuals. Even with common parentage, each comes into the world with his or her own individuality. Father and mother accept this fact. From the first each child has been different to them, different not only in the more obvious physical characteristics but likewise in

(*Courtesy of Pasadena Public Schools.*)

(*Courtesy of Los Angeles Public Schools.*)

(*Courtesy of Pasadena Public Schools.*)

As children develop they project themselves into the life about them.

disposition. Each has gone about work and play in his own way. Jimmie is spirited, persistently curious, dynamic, somewhat inconsiderate of others but nevertheless holds a deserved reputation of generally playing fair. Jane is quiet, sensitive, businesslike, intelligent but not given to pushing out into unknown territory as did Jimmie at her age. Though Jimmie is older than Jane and in many ways is a more stabilized personality because of his age, yet in the eyes of his parents his future development represents a wider range of possibilities, for they know he is the kind that will not stay put. As for the baby, he has always been happy, bright, and lovable and gives promise of a well-balanced personality.

Even if children of the same family were born with much the same potential characteristics, the differences in their environments would lead to variation in character. Jimmie, for example, has no older brother, and Jane has, whereas the baby has an older sister as well as a big brother. Such differences are important factors in the development of personality. Jimmie enjoyed the lavish attention and admiration of the parents of the first-born, but the baby finds himself in a world of wiser parents. Thus each child brings to life individuality, and the environing circumstances of his growing years lead to even greater individuality.

Life Has Direction and Purpose.—The Nelsons live in a complex world of things to eat and wear, in a world of machines, homes, factories, railroads, steamships, airplanes, newspapers, telephones, telegraphs, radios, and other tools of production, in a world of interchange of goods and ideas. Children born into this world find the ways of living together already organized into complex social customs and institutions. This stream of civilization is dynamic; it moves out of the past into the present under the motive power of dynamic human beings who have accepted this scheme of things as their own and who in turn contribute to it new ideas and new institutions. Thus, dynamic human beings and dynamic culture unite to give life its present

power, its "carry," its "go." New direction is given to the stream of life through new inventions, through changing social organization, and through new purposes and goals. Man looks behind and ahead—he lives the present with an eye to the past and future. Characteristic of all his personal and social activity is his sense of direction and purpose, his setting of goals. His purposes may be muddled or well defined, sordid or ideal, grasping or altruistic; they may be immediate and firsthand to meet a present crisis, or they may be those of a lifetime; they may be those of a lone individual or shared with a whole nation. But on whatever level you find human experience, the purposes and goals of the individual give direction to his life.

The Adaptability of Mankind to Environment.—One marvels at the complexity of our man-made modern life, at the creative capacity of human nature that results in such development, and at the adaptability of human nature that makes it possible for anyone to adjust intelligently to such a life. When Jimmie's father was a boy, bicycles were to him strange and wonderful things and automobiles were even more so. To Jimmie his bicycle is a casually accepted possession, and he gains his skill in riding quite as casually as he accepts his possession. Children find themselves in a world that looks expectantly for their adaptation to its complexities. Parents await and watch the growth that changes the baby into the child, the child into the youth, and they anticipate natural development by trying to hasten the learning processes. The Nelson baby would learn unaided to walk, but all his family delight in helping him even before he is ready. The baby will learn to talk, but the family is eager for him to talk as soon as possible. His natural development from within is matched with the social situation without, both working together in the great game of adapting a human being to the life about him.

For some years Jane has sensed the nature of this great game of learning and has given herself wholeheartedly to it. She is keenly aware that she has taken her part in real life

when she has helped her mother with the evening meal or has gone to the grocery store to buy needed articles. Jimmie is even more definitely involved in this game of learning than is Jane. The longer period of his development has given him more ability to meet situations, such as going to school, riding his bicycle, meeting strangers, and earning his spending money. Thus, growing children develop attitudes that are at the very root of their developing capacity for adaptation. The expectancy of the world about them is matched by their own expectancy; their sets of mind and bents of developing character are directed to the business of learning and making adjustments to the life of which they become more and more a part.

The lives of the Nelson family are intricately related to their environment. It is obvious, at least after consideration, that they cannot live isolated from it. Life is, indeed, the relations that are established and maintained with the social and material world, and we cannot understand an individual except in relation to his environment. This basic fact seems so evident that we may easily underestimate its significance in our study of human behavior. In the chapters that follow we are persistently faced with the fact that our study of living and learning centers in the problem of adaptation between the individual and his environment.

We Interpret Particulars in Relation to Larger Wholes.— In judging the actions of another person we are on sound ground only when we interpret his particular behaviors in their relation to the larger whole of his life and his personality. Nevertheless, we find ourselves at times so concerned with bits of behavior that we forget that they are parts or aspects of larger wholes, and presently we are interpreting the wholes as but the sum of the parts. For example, we easily fall into a way of considering our breathing as one thing and the beating of our hearts as another, when we can really understand either of them only in relation to the other and in relation to the larger whole of physiological activity. We easily fall into a way of thinking of particular

habits as quite independent and isolated bits of behavior and even try to develop them as such, when, as we shall see later, habits and skills, just as breathing and the beating of the heart, are really inextricably related to the whole of our behavior.

The larger wholes of life provide the basis for understanding why both children and adults behave and respond as they do, not only in such matters as breathing and habits and skills, but in all their behavior. It is not hard to understand why Jimmie's reading is good when we see how it has become tied up with the things that mean most to him. He loves his father, and he is much interested in all that goes on at the roundhouse. His father has bought him storybooks about railroads, and Jimmie has obtained other books from the library. He reads in the local newspaper of the happenings in the railroad world. He knows well many of the railroad men, and both reading and the life it tells about are real when he finds in the paper that "Fireman E. Weekley was used doubleheading on No. 79 in place of Langhoff." Spelling does not have such a vital setting in Jimmie's life, and his teacher cannot understand why her method of teaching spelling fails to get desired results.

In the following chapters we shall study many particulars of the human organism, and we shall be concerned with particular phases or aspects of human behavior; but if these particulars are to be understood, they must be interpreted in terms of the larger whole of which they are a part. We find these particulars of behavior entering again into many kinds of experience, but we can best understand how this is possible by understanding how they originated.

The Nature of Learning.—Our everyday observations of growing children reveal an intimate relation between their growth, maturation, and learning. To Jimmie his dad-as-foreman-at-the-roundhouse grows in significance. His understanding of the roundhouse world is ever expanding. Jimmie sometimes goes with his father on the inspections that he makes, and he notices things about the machines that he has

not noticed before, although they have always been before him much as they are now. He is not satisfied with just noticing; he wants to know all about them, and while he is asking questions and learning more about them they are continuously changing for him. The evidence of this changing world is reflected in his common expressions, "I never noticed that before," "I see that now," "Oh, yes, I see." Jimmie, like many another, is impatient with his own learning; he wants to learn everything at once. He is always asking, "Dad, why didn't you tell me that before?" And his father answers, "Son, you can't learn everything at once. I'll help you when you are ready to learn."

To the learner the thing to be learned is a goal—an apple to be reached, a chair to be climbed, a book to be read, a pie to be baked, a life problem to be solved. Sometimes the goal may not be very clearly defined; yet it gives direction to experience and to learning. To Jimmie at three years of age one thing to be learned was knowing a locomotive—knowing it in a way that let him stand a short time in its quietly throbbing cab, with fear halted, curiosity satisfied, and joyful consciousness of his father's approval. At seven years of age it was learning the same locomotive but at another level of insight and understanding; the locomotive had then become something which Jimmie interpreted as a great engine that heated water into steam when a fireman threw coal into a roaring firebox, that moved great strings of cars when the engineer pulled a throttle to let the steam move the great drive wheels. Jimmie cannot tell you how he learns, but he knows when he has learned. He knows when the goal of his learning is reached. At three he was satisfied, and at seven he was satisfied; but at all ages his own development and the changing life about him conspire to raise new problems and set new goals that demand new levels of insight and understanding.

Thus, *things learned* at a given time involve more than mere objects. Learning involves growth and maturation of the learner; it involves life purposes in which the objects

(*Courtesy of Los Angeles Public Schools.*)

(*Courtesy of Los Angeles Public Schools.*)

(*Courtesy of Los Angeles Public Schools.*)

Learners respond to worth-while situations.

play a part. The locomotive is much the same locomotive year in and year out, but it means one thing to his life when Jimmie is three years of age and quite another thing when he is seven. At either of these ages it would be nonsense to set as his present goal his father's level of understanding. It is therefore merely good common sense to say that what is learned depends upon the learner's present level of maturity and upon his present insight and understanding. He will never learn unless there is something to learn, something that can arouse him, something that sets a problem at his growth level. Without these qualities all the things of the outside world can never, of themselves, make this experience we call *learning.* Both responsive learner and a thing to be learned are essential to it.

Learning Is Emergent.—Learning comes when the learner is ready. It would be useless to try to teach calculus to Jimmie. He might be able to repeat definitions, say what he is told to say, but he would not understand and could not use his knowledge. He can learn about a locomotive, but what he learns depends upon his level of development and his insight into the world of locomotives. When he learns anything that throws new light and new understanding upon a situation, such understanding is a natural growth rooted in previous experience and understanding. This new understanding is not like stones added to the top of a rising wall but like new buds, shoots, and branches that emerge from a living tree, emerging as natural growth of the living plant, new in themselves and renewing the life of the whole tree.

Being ready is the key to such learning, and being ready means two things. (1) It means that the learner is old enough in years, mature enough, so that he may be expected to solve the problem before him. (2) It means that the learner has had experiences related to the situation at hand but of a simpler order, so that when the situation is presented he recognizes it as a problem and can make progress toward its solution. Children do not develop at the same

rate, and so, even when of the same age, they do not have the same general maturity. To these differences are added those arising from the lives they have lived; the differences in the particular experiences they have had bring them to a particular problem with different abilities to cope with it. Variation seems to be the rule, variation in rate of general development and in the background of experience.

The picture drawn of the lives of the Nelson family is intended to be typical. Other lives might have been taken as examples, and they would have revealed the characteristics that are common to human beings. It is only through studying human behavior as we find it that we will come to a better practical understanding of it. Life as we find it is complex, whether considered from the angle of the human beings who spend many years of their lives growing and taking an increasing part in life or whether viewed from the environment to which they must adapt. Our study is not made easier by the fact that human beings vary so greatly in their individual natures.

Summary: Points of View for Our Study.—In order to proceed with a common understanding let us set down definitely the viewpoints that are basic to the study of human behavior in ensuing chapters.

1. Human life, human experience, human behavior are always active and ever changing; we study them in action.

2. Life has direction; it is not aimless. It is *purposive* or *purposeful.* Growth is *purposive;* we know that under normal conditions the mature being will develop from the embryo. There is *purpose* in choosing food, and *purpose* is implied in our attitudes toward life, in our dynamic disposition to learn.

3. Human behavior is essentially social. We are born individuals, but we develop our personalities through social cooperation and social conflict as we make a place for ourselves in the civilized life about us.

4. Human behavior at a given time must be interpreted in its setting in the larger whole of the life of the individual

and of the life about him. We should study particular human behaviors both in their social setting and as a stage in a lifetime of development and change.

5. Understanding of the growth processes and their maturation in the course of experience is essential to an understanding of behavior. Growth, maturation, and learning are united aspects of development.

6. Many levels of activity are discernible within human behavior, some being simple, others complex, some on the level of mere existence as when we sleep, others on the level of creative thinking.

Though our object in studying human nature is better to understand individuals, we shall first try to understand those things that are common to all individuals. We shall study human nature in general as the basis for understanding individuals. Having studied human beings in general, we shall eventually come to the study of their differences and the development of the personality of individuals.

SUGGESTIONS FOR NOTEBOOK AND BULLETIN BOARD

1. Make a pictorial summary of the more significant aspects of everyday life. The illustrations might follow the development of divisions of this chapter, or you may wish to use an organization of your own. A group of illustrations might be arranged under the title "The Stream of Life," with captions for illustrations, such as "Born individuals, children become more individualistic," "Caught up in the stream of social relations," "Surrounded by an organized world," "We understand individuals when we understand their background."

DIARY OF YOUR OBSERVATIONS

1. Choose several children of different ages, and note the kinds of social adjustments they have made, within the family and with the world outside the family circle.
2. When you first entered school, were you "ready"? Recall as best you can your attitude at that time. List some of the cir-

cumstances that you think might have contributed toward your attitude.

SUGGESTED READING

1. In the folkways of primitive tribes are found interesting contrasts which help to make us aware of the influence of the social and cultural environment in the lives of modern children. In Chap. 22, *Handbook of Child Psychology*, edited by Murchison, Carl (Clark University Press, 1931), Margaret Mead, under the title of "The Primitive Child," describes briefly some of these contrasting cultures.
2. In the same volume, in Chap. 11, Jean Piaget has briefly surveyed "Children's Philosophies." This chapter will give the reader an understanding of the problems a child has in adjusting to the world about him. Can you recall your childhood notions of shadows?
3. You will be interested in the *Autobiography of Lincoln Steffens* (Harcourt, Brace & Company), which contains a very interesting portrayal of a boy's experiences.
4. Benedict, Ruth, *Patterns of Culture* (Houghton Mifflin Company, 1934) gives interesting views of culture patterns among Indians.

Chapter Three

Human Development before Birth

Some look upon the time of birth as the beginning of a human life, but one cannot really understand human beings and the way they behave until one has some comprehension of the development that precedes birth. As was suggested in the previous chapters, there is much to be gained through studying the developments that lead up to any event, and this is certainly true when one tries to understand the complex behavior of the human organism.

The human organism develops as a whole, each stage of its development being adequate for that stage, yet leading to the next stage in which the whole becomes more complex. As this development proceeds, particular parts of the body and particular patterns of behavior gain a great deal of individuality and independence, but at the same time they are dependent upon other parts and other patterns of behavior. Parts must work together to maintain the unity of the whole. In the prenatal period, as in later life, environment is an essential factor in growth and development. The protected existence that the organism lives before birth demonstrates very pointedly the part environment plays in development. The inherited potentialities of each individual, which make children to some degree like their parents and grandparents, are essential factors in determining what an individual will become, but the fulfillment of these potentials involves the interplay of the developing

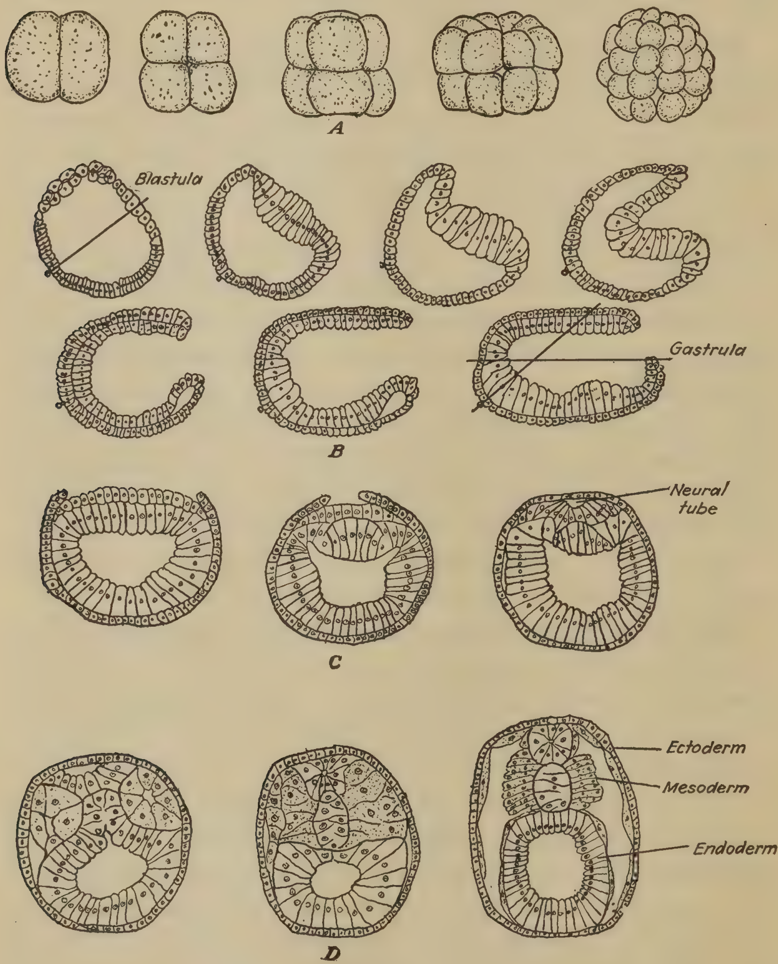
parts of the growing organism as it maintains life relations with its environment. In this drama of growth and increasing complexity are to be found the basic principles that will help us understand human behavior.

Embryonic Development.—The human organism has its beginnings in the union of reproductive cells, a male and a female cell uniting to form the single cell of the new organism from which the embryo develops. Since in this cell there is the beginning of many cells, we shall call it the *parent cell.* Within the parent cell are the potentialities for growth, but like all living organisms the parent cell must depend upon its environment for the food, warmth, and stimulation without which the potentialities would never become realities. Extremely minute particles, called *genes*, are the carriers of the growth potentials which determine the general nature of the development that takes place. The genes are present in both the male and the female reproductive cells, and the baby may therefore develop characteristics of both his parents. The growth of the embryo is a product of these hereditary growth potentials and of the environment within the mother's body.[1]

The Single Cell Becomes a Complex Organism.—With the essential environmental conditions present, the single parent cell lives and grows. The 1 cell divides into 2, the 2 into 4, the 4 into 8, the 8 into 16, and so on. Within the course of a few days the embryo has taken the form of a hollow sphere, its wall a single layer of cells. At this stage, each cell of the embryo is much like the parent cell; for each is a direct descendant of it, and the conditions of growth have been much the same for one cell as for another. Each cell has lived in much the same relation to other cells, since in making the wall of the sphere each has presented much the same surface areas to adjoining cells. But these conditions cannot continue indefinitely. Even at the time of union of the male and female cells there is evidence in the egg cell of the beginnings of differentiation. With the

[1] Chapter XIII gives a more complete discussion of inheritance.

increase in the size of the embryo there must inevitably follow a change in the relations of different cells to food supply and to the stimuli that are essential to growth. The



THE DEVELOPMENT OF THE EMBRYO.

A, early stages of cell division; *B*, formation of the blastula; *C* and *D*, early stages of differentiation. (*From F. C. Sherbon, The Child.*)

sphere folds in, and the folded edges join together so that the embryo takes on the shape of an irregular cylinder. Two layers of cells, one within and one without, now form

the walls of the embryo. From this simple beginning embryonic life becomes more and more complicated.

The Beginnings of Differentiation.—With this change to a cylindrical shape there are, for the first time, marked differences in the relations of cells to their environment; also, the first marked differences in the relations of cells to other cells and the first marked differences in the newly developing cells themselves appear. Until this time, conditions of growth were much the same, and consequently the new cells that developed were much the same. Now the change in shape has changed the conditions under which different cells live, changed the relations of cells to other cells, and there results the beginning of growth of *different kinds* of cells. Here are found the three factors that account for the developments that follow: (1) differences in relation to environment, (2) differences in relation of cells to other cells, resulting in (3) differences in the nature of new cells even though these are alike in their capacity for growth.

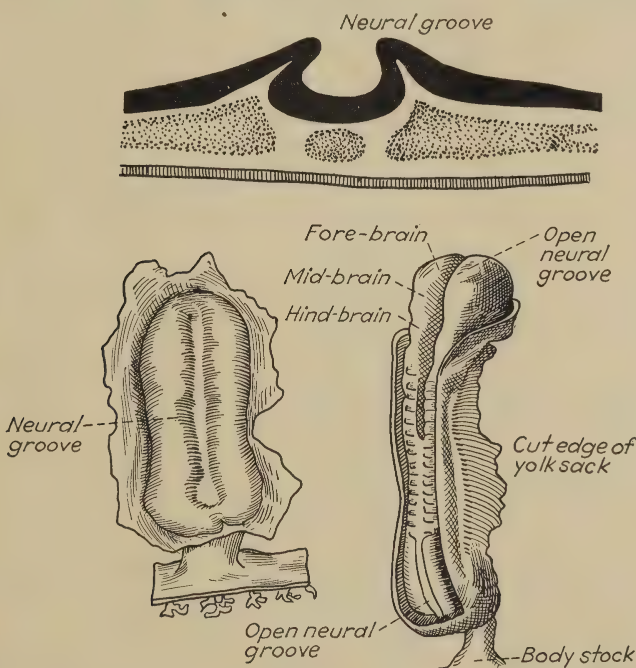
The conditions under which different cells now live vary. All cells are not in direct contact with the source of food supply, the inner layer of cells being dependent upon the outer layer for some of the essentials of life; the inner cells thus establish new relations with the outer layer, they live differently, and they become different because of this different life. Very soon, further differences appear in the relation to environment, in the relation of cells to cells, and in the kinds of cells that result from the different life within the organism. Between the two layers of cells a third layer begins to appear. These three layers are known as the *basic tissues*, for from them develop all the various organs and tissues of the body. Cells of the inner layer multiply and become the inner cells of the digestive tract, trachea, lungs, liver, and other visceral organs. The cells of the middle layer develop into the muscles and bones of the limbs, trunk, and head, into the muscles of the heart and blood vessels, and into parts of the ureterogenital organs. From the outer layer of cells develop the hair, nails, skin,

certain parts of the eyes, nose, and mouth, and also from this outer layer emerges the nervous system.[1]

The Development of the Nervous System.—The first sign of the nervous system is a groove which forms where the edges of the collapsed sphere meet as it folds together to make the cylindrical embryo. This groove extends the length of the cylindrical embryo. One end of the groove shows a more rapid growth than the other, and the head of the embryo forms at this end. Indeed, in connection with this stage of development, the term *head* means, more than anything else, the area of dominant growth. This neural groove deepens; its sides rise, fold over, and join together; and the groove becomes the neural tube which persists throughout life. From the walls of this tube the nervous system develops. The end of the tube at which growth is dominant develops into the brain and persists throughout life as the dominating center of the nervous system. Soon, secondary centers of growth appear along the tube where the arms, legs, and other important parts of the body begin to emerge. In the folds that lapped over to form the tube, masses of nerve cells develop at regular intervals to form the sensory ganglia. From these ganglia, or masses of nerve cells, grow the nerve fibers that will eventually form nerve trunks reaching to the sense organs in the eyes, ears, mouth, nose, skin, muscles, tendons, and other parts of the body. Motor nerves form in the brain area and send down fibers that make contacts with other motor cells developing within the tube, and the fibers of these cells in turn extend to all parts of the body and connect with the structural muscles. Still other cells migrate from the neural tube into the innermost layer of cells of the embryo, and from them develop the groups of cells called *sympathetic ganglia*. Nerve fibers from these ganglia lead the way in the development of the visceral organs and carry impulses to these organs throughout life.

[1] The technical names for the inner, middle, and outer basic tissues are *endoderm*, *mesoderm*, and *ectoderm*.

Thus the human organism begins its development. It was originally a single parent cell, then a hollow sphere made up of cells closely resembling the parent cell, then a cylindrical mass in which three layers of tissue differentiate; these basic stages in differentiation lead ultimately to dramatic development of tissues as varied as bones and nerves and skin and red corpuscles. Such is the history of prenatal life.



Development of the Neural Groove in the Embryo.
(*From R. H. Wheeler, and F. T. Perkins, Principles of Mental Development, Thomas Y. Crowell,* 1932.)

Development Is Orderly.—The development of the organism takes place in an orderly fashion; at every stage it is organized to meet the needs of that stage. As the embryo grows and differentiation of tissues proceeds, a higher level of coordination of part with part becomes necessary to maintain the unity of the life of the whole. Coordination between parts is so basic to this development that if the

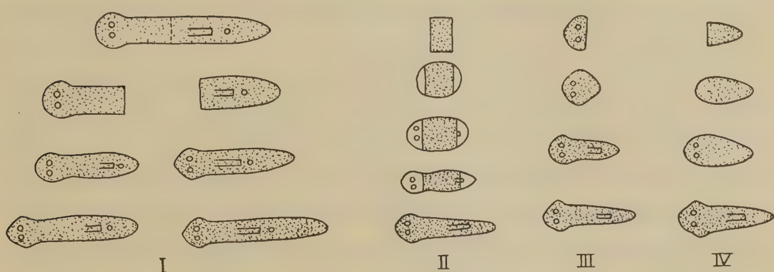
organism had need of a slogan it might well be that of the Three Musketeers, "All for one and one for all." The cells, in a very real sense, live for the whole organism, and the organism can live only in and through its cells. Throughout life, as throughout embryonic development, this relation of part with part to maintain the unity of the whole is found to be one of the basic principles of life and human behavior.

Parts Depend upon the Whole.—This relatedness of part to part is dramatically demonstrated in the early periods of embryonic life. Within a few weeks groups of cells become differentiated into organs with specialized functions suited to the particular stage of development. Some of these organs will disappear entirely or be modified to fit the needs of later stages. An example of this modification of parts in relation to the rest of the embryo is found in the organ that is first developed to provide an avenue of excretion. This organ is called the *Wolffian body*, so named for the man who discovered it. It is formed by the end of the fourth week. By the end of the seventh week the umbilical arteries and veins have developed and, through their indirect connection with the circulatory system of the mother, have become the new avenue for the elimination of waste products of the embryo. With this change in the life of the organism, the Wolffian body is no longer needed and parts of it disappear and other parts are modified to become portions of the developing organs of the ureterogenital system.

Further example of the dependence of parts upon their relation to the whole life of the organism is found in later changes in the circulatory system of the blood. Prior to the birth of the individual, only certain parts of the circulatory system found in the mature organism are called upon to function; other parts are relatively inactive. Before birth, oxygen is supplied to the embryo through indirect connection with the circulatory system of the mother, and there is no need and no possibility for the lungs to function. No oxygen is to be got from the lungs, and so no blood flows to the lungs for that purpose. At birth, when for the first time

air is taken into the lungs, the course of the blood through the heart is changed so that blood flows to the lungs to get the needed oxygen. With this change certain parts of the prenatal circulatory system, shorn of their function, disappear.

Basic Factors of Orderly Development: Relatedness, Growth Potentials, Environment.—There are, it is evident, three basic factors determining the growth and development of the human organism: (1) the growth potentials of the organism; (2) the relatedness of one part to other parts within the whole organism; (3) the relations that must be maintained between the organism and its environment. As



The Flatworm Regenerates from Sections of the Whole Worm.
I, from front and rear halves; II, from a midsection; III, from a head; IV, from a tail.

long as cells are alive, relations between cells and other cells and between cells and the environment persist. Let us turn from the embryo to observe the operation of these factors in experiments with lower orders of animals. A simple organism, the flatworm, furnishes a good example. Experimentation shows that the flatworm may be divided into two parts and both parts thereupon will grow the respective head or tail needed to fill out the complete organism. When the flatworm is divided into three parts, head, tail, and middle, each portion will develop into a complete flatworm. At the two severed ends of the middle section new tissue develops into the head and the tail, the head growing at the end nearer the original head and the tail growing at the end nearer the original tail. Apparently, the cells of this mid-

portion have retained their original capacity to develop into different cells, and, when they are released from their old relations, they form cells of head and tail to complete the whole organism. Similarly, the head section develops whatever new cells are needed to make a whole new flatworm, and the tail section does likewise. The environmental factor is clearly a part of this development, as well as the factors of growth potentials and organic relations of part to whole. The environmental factor is revealed most pointedly when the conditions of temperature, nutrition, and moisture are varied. Parts favored in these respects develop differently from parts less favored, with the result that the regenerated organisms vary considerably in their final size and shape.

One needs to look no further than to the last time one's finger was cut to see the operation of these factors of growth potentials, relatedness, and environment. New tissue fills in the cut with muscle, nerve, and blood vessels, all replaced in orderly manner by the growth of new tissue from adjoining tissue. The healing of such a wound will vary with its severity, that is, with the degree to which the established relations of tissues have been interfered with. The healing will also depend upon the care and protection it receives, that is, upon the environment. When conditions are favorable, the growth potentials and organic relatedness may be depended upon to recreate the whole. There may be only a bit of scar tissue left to mark the scene of this miracle of regeneration which has been accomplished through the operation of the same factors that controlled the original development of the organism.

Failures of Relational Factors Reveal Basic Principles.—Equally interesting to consider is the situation in which for some reason these factors fail to operate in balance. We are all familiar with twins, fraternal and identical. Fraternal twins are as different as brothers and sisters born at different times. They develop from two different female and two different male reproductive cells which unite in pairs to

form the parent cells of two independent embryos. Identical twins, as the name implies, are alike. Their identical nature is understood from the fact that they develop from the union of one female and one male cell which unite to form a single parent cell. At some time in the very early stages of cell division the organism fails to hold together and separates into two parts which thereafter have independent developments as separate embryos. It may be that environmental conditions, perhaps the condition of food supply or some fortuitous circumstance, are responsible for the separation of the single organism into the two independent embryos. The factor of organic relatedness is revealed in the failure of the original organism to maintain its unity. The growth potentials are revealed in the likeness of the two individuals. With some mammals, in certain species of the armadillo, for example, it is the normal occurrence for the embryo in its early stages of development to separate into several parts which develop into different individuals that are very much alike. For some reason the conditions necessary for maintaining the unity commonly found in the developing embryo are lacking, and the result is several individuals of almost identical pattern.

Less agreeable to consider, but illustrating the operation of these basic factors, are the situations in which growth potentials and relatedness are so out of balance that groups of cells establish independent organizations of their own, such as warts, moles, and cancers. These growths maintain a relation with the rest of the body, but it is essentially a parasitic relation. The rule of "All for one and one for all" does not hold for them. Some maladjustment with environment such as a bruise or irritation may have been the occasion for disorganizing established relations, and the growth potentials seem to impel the cells involved into an anarchistic career of their own. Unless brought under control, such cell growths not only disturb the unity of the organism but may entirely destroy it. Less observable but nonetheless to the point is the consequence of the lack of balance in the

function of the endocrine glands; the sluggish activity of the thyroid gland, for example, may be responsible for sluggishness and a low level of mental development, whereas excessive activity of this gland leads to goiter and an accompanying irritability in the behavior of the individual.[1]

Summary: The Basic Principles of Growth.—From the surveys of development and organic activities just made, three factors are seen to be in control of the growth and development of the human organism.

1. The first of these is the factor of inherited growth potentials in the genes. Under normal conditions, the human embryo can develop into nothing else than a typical human being, with features formed as in other human beings and with arms, legs, hands, feet, and other parts of the body that function as in other human beings. Within each cell is found the full range of possibilities of development, the full range of growth potentials that are characteristic of the human organism. The range of growth potentials is sufficiently great to permit the wide diversity of development found in muscles, bones, hair, nerves, and secreting glands. These potentials are inherited. They are what they are because of the parentage from which they spring.

2. There is the factor of environment. From the beginning of embryonic life until death the activity of the organism is forever directed toward maintaining working relations with its environment. Food, oxygen, and stimulation necessary for growth are obvious items in this relationship. To these may be added a wide range of environmental conditions that keep the organism continuously adjusting to changing conditions of life.

3. There is the factor of relatedness of part to part within the whole. It is obvious that the development and activity of the different organs and tissues can take place normally only in relation to other organs and tissues. Both during their development and during their continued ac-

[1] More details of balanced endocrine activity are given in Chap. VI.

tivity, living cells are related to other cells. Individual cells, tissues, and organs grow and live and do their work, not in isolation, but as integral parts of a complex organism maintaining life relations with its environment. They arise as parts of a larger whole, and they function as parts of a larger whole.

In these three principles we find the general guides to our thinking concerning human development and behavior. (1) The organism has within it growth potentials conditioning its development in line with the form, structure, and behavior of the parentage from which it springs. (2) Development and life are necessarily directed toward adaptation to the environment, which presents the ever changing conditions of food, air, light, warmth, moisture, and other circumstances to which we must adjust. (3) Growth takes place through a process of differentiation of parts, which vary in structure and in function but which maintain a balanced relation, one part with another, in a unified development of the organism as a whole.

The continued development of the individual proceeds in accord with these three principles, and its activities as a mature organism are likewise in accord with these three principles. More of how this organization is effected and of how parts influence parts to maintain an orderly whole in the activity of the organism is discussed in the next chapter.

SUGGESTIONS FOR NOTEBOOK AND BULLETIN BOARD

The following suggestions are concerned with the fundamental ideas developed throughout this and the next two chapters. The notebook and bulletin-board materials may therefore be selected and organized for a comprehensive presentation to cover these basic principles of human development and the human behavior that results from this development.

1. Organize a series of illustrations, news items, and notes on your own observations which show how inherited growth potentials influence human development and behavior.

Examples used in the chapter will be suggestive of many possibilities. Columns under "Medicine" and "Science" in weekly news magazines may hold interesting items bearing on these principles.

2. Develop another series of illustrations, related news items, and notes to show that parts must be functionally related to be parts of a living organism. There is the possibility, for example, of illustrating the following: (*a*) Parts of machines remain potential parts. (*b*) Parts of lower organisms change to become wholes, as in the case of sections of the flatworm. (*c*) In highly differentiated organisms, parts lose their life characteristics when separated from the complex whole. (A thumb off a hand is what?)
3. The development and behavior of an organism cannot be interpreted except in relation to the environment of the organism. A third series of illustrations, news items, and notes of observations may be developed to show that in life an organism and its environment are united. The three basic principles set forth in this chapter are so much a part of life that the evidence is very close at hand, so close that you may find it hard to see. It should be noted again that good selection and good organization of material are much more important than large quantities badly organized. Save many illustrations, news items, and notes on your observations, but use them to tell a definite story.

SUGGESTED READING

1. Even a limited reading in a well-illustrated textbook on embryology will help the reader to get a better understanding of the interesting drama of prenatal development of the human organism. The reader may wish to turn to Chap. XIII of this book, in which a more detailed study of inheritance is made in connection with the problem of individuality.
2. Chapter 4 (pp. 60–81) of *Developmental Psychology*, by Goodenough, Florence L. (D. Appleton-Century Company, Inc., 1934) gives an account of prenatal development that is a valuable supplement to this chapter. In Chap. 5 (pp. 82–112) of the same reference will be found a good description of the differentiation of nervous tissues and sense organs.

Chapter Four

How Is Behavior Controlled?

The drama of human development which begins before birth continues through childhood and youth. In general, the older children are, the more they are able to do. Not only do they do more things, but they do more difficult things, and they do them better. With this remarkable increase in diversity, complexity, and facility of behavior, the organism continues to be orderly, and its activity is controlled and unified. To be sure, there are times when we stumble over our own feet, when our fingers are all thumbs, when we stammer in embarrassment, perhaps because our thinking is muddled, but these disorganized occasions are the exceptions rather than the rule. As a rule, the activities of an organism are organized and controlled; and if they are not, we look for them to become so in the course of normal development and through learning.

The question is: How does one part of an organism exert influence upon other parts so as to maintain this unity? For the answer to this question, we first turn to the behavior of organisms much simpler than the human being. Though other organisms may be much less complex than human beings are, they too must act as wholes; their activities must be organized so that the parts act in relation to each other to maintain unity of behavior. In studying simpler organisms, we find more easily the main threads that are woven into the story of organic control.

Behavior Is Patterned.—A person's behavior is what he is doing; anything he does is a behavior pattern. When a man walks, this walking is a pattern of behavior, one that is different from that of a walking dog.

Each species has patterns of behavior that are in many respects its own. An ameba is a simple one-celled organism. A grasshopper is a more complex organism. A human being is probably the most complex of all organisms. An ameba cannot behave like a grasshopper, and a grasshopper cannot behave like an ameba. Neither of these can behave like a human being, and human beings persistently behave like human beings. The ameba, the grasshopper, and man all respond to stimuli and take in food and digest it. They breathe, create new types of energy within their bodies, and move from one place to another, but they do these things differently. The ameba does not hop like a grasshopper, and neither of these walks like a man. Though it is probably true that no two men walk just alike and no two grasshoppers hop in precisely the same way, yet each species has its characteristic way of getting about. It has basic patterns of behavior for its many other essential activities. These are but parts of the larger general patterns of behavior that distinguish each species from all others.

To be sure, the structure of these organisms differs one from the other, but an organism's pattern of behavior is of more significance to us than the design of its structure. We are concerned about grasshoppers because of what they do. Perhaps we have never been interested in either the structure or behavior of the ameba, but once having examined the ameba under the microscope we are not satisfied until we have seen it do something. We are interested in how the human organism is built, but we are more interested in how it moves, how it gets food and digests it, how it breathes, what it does in unusual situations—in short, how it behaves and how it is organized and controlled to behave as it does.

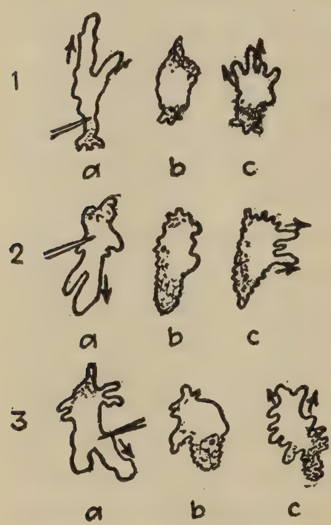
Orderly Behavior in the Ameba.—How does a simple one-celled animal like the ameba organize and control its

behavior? The ameba we see under the microscope is one of a line of self-regulated amebae. Where the line originated is as much a question as where any other living organism originated. Undoubtedly it has taken a long, long time—many, many, generations—for amebae to become what they are. During this time, they have come to behave like amebae; they have established their own characteristic way of doing things. True, when compared in respect to development with the human organism, the ameba appears not to have got very far. To many it is merely a "blob of protoplasm"; but it is, nevertheless, an organization of living protoplasm, and it regulates its behavior in a way that is becoming to its own kind.

In common with human beings and other organisms, the ameba must eat to live. If a speck of food is placed near by, the ameba extends parts of itself in the direction of the food; and shortly these extensions, called *pseudopods*, reach around the particle while the remainder of the ameba follows in the direction of the advancing extensions. The reaching for food, the moving toward it, the taking it in, and the digestion of it are all done by a single cell. If the food had been presented on the opposite side, the pseudopods would have been extended from that side to take it in. There is no permanent fore or aft to an ameba; there are no permanent hands with which to reach for food, no legs to move it from one place to another, no mouth with which to take in food, and no special digestive organs. For its food-getting activities the ameba depends upon its ability to extend pseudopods.

When an ameba is pricked with a needle, it moves away from the irritation point, the movement starting with the extension of pseudopods on the side opposite the needle, with the remainder of the cell following after. If the ameba is moving toward food and receives a needle prick from the front, it stops and pulls in the pseudopods that are extended in that direction, then extends pseudopods in the other direction. Whenever it is forced to set up a new pattern of

behavior, it first gathers itself for the new activity by drawing in the pseudopods that may be active at the time. The characteristic behavior of extending pseudopods with the remainder of the ameba following after serves for taking in food and for getting away from undesirable environmental conditions. Even when the ameba is moving in the direction of food and is pricked from behind, it will first draw in the extended pseudopods, seem to gather itself, and then extend the pseudopods in the same direction it was originally going. We may rightly conclude that the ameba can do only one thing at a time and has its own way of doing what it does.



Reactions of Ameba When Pricked with Needle.
1, from the rear; 2, from the side; 3, from the front side. (*From N. R. F. Maier, and T. C. Schneirla, Principles of Animal Psychology.*)

How Does the Ameba Organize Its Activity?—Why does the ameba take the right direction toward food and away from needles? Why do not the pseudopods extend sometimes in the wrong direction, or possibly some of them in one direction and some in another? What determines which part shall go first and which shall come after? In other words, how does behavior become organized so that the ameba behaves as a unit and behaves appropriately in each situation?

Let us see if there is a reasonable interpretation of what takes place within the ameba when it moves toward food and away from needles. When food is presented from one side, the side nearest the food will first receive the food stimulus which is carried to it by the moisture that is present in the environment. The part that has received the stimulus first will naturally respond first. It will respond in

the manner characteristic of amebae by extending pseudopods. It is simple to determine which part goes first, and it is not difficult then to determine which parts come after. The activity of the part stimulated affects adjacent regions, these in turn affect those parts still farther removed, and thus the whole cell becomes active. These more remote parts get only secondhand stimuli; and since the side nearest the food continues to receive stimuli, it continues to be more active than the more distant parts. The side nearest the food persists in leading the way because it is more highly stimulated; it becomes the center of dominant influence for the other parts. Thus, the whole ameba becomes organized into an orderly behavior pattern with one part taking the lead and the other parts following.

Organization for a Negative Response.—A new situation is presented for interpretation when the ameba is pricked with a needle. Let us suppose that the ameba is moving toward food and that the needle stimulus is applied from the rear. The excitation set up by the needle seems to be so strong that the food-getting pattern of behavior is broken up, the pseudopods that have been extended are withdrawn, there is a short pause when no activity is observed, and then pseudopods are again extended on the side opposite the needle. If the needle stimulus comes from one side, the same breaking up of the existing pattern will be seen, but the retreat will be in the direction opposite that of the needle stimulus.

The ameba takes the right direction to get away from the needle, but how does it become organized to do this? The strength of the stimulus is undoubtedly the important factor in determining how the behavior will be organized. It is reasonable to think that the strong stimulus of the needle will cause an excitation which will be transmitted quickly and strongly to all parts of the ameba. This excitation halts and disorganizes the existing pattern of behavior, and the pseudopods extended toward food are therefore withdrawn. It seems as though the whole organism were

shocked and the region of least shock, which is farthest away from the needle stimulus, recovers first and resumes the characteristic activity of extending pseudopods, thus becoming the center of dominance in the organized behavior that takes the ameba away from the needle.

In brief, the regulation of the behavior of the ameba takes place through the *dominance of one region over another.* This dominance arises from the heightened excitation and heightened activity of one region as compared with lower levels of excitation and activity in other regions. Within a certain normal range, the stimulation leads to positive or approaching behavior, whereas extremes of stimulation outside this range upset the existing pattern and lead to negative or retreating behavior.

The Ameba Learns: It Reorganizes Its Behavior.—The ameba is not so machinelike in its behavior as one might conclude from the above descriptions. It can profit by experience, although it cannot remember its lesson for any length of time. The single cell has so many different things to do that it cannot be expected to have a behavior pattern that is highly specialized and educated. It does learn, however, even though it may soon forget. If a particle of glass or carbon is vibrated in the vicinity of the ameba, it will take it in as though it were food but in a few minutes will expel it. When the material is presented a second time, the particle will not be taken so completely into the body before it is expelled. With repeated presentations the behavior of the ameba is progressively modified until no movement is made toward the material. But the ameba soon forgets this lesson, and it is doubtless well that it does, for the ameba has no way of determining whether substances are digestible except by taking them into the body and it would be deprived of much food if the lesson persisted.[1]

What Constitutes Normal and Extreme Stimuli?—It may appear that our interpretation of the problem of positive

[1] Schaeffer, A. A., "Choice of Food in Ameba," *Journal of Animal Behavior,* Vol. 7, pp. 220 *ff.*, 1917.

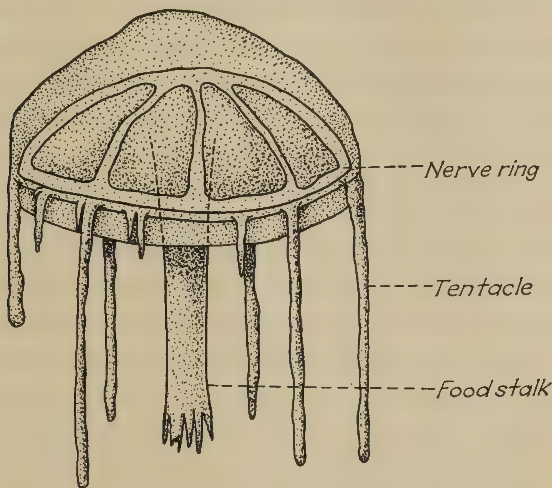
and negative behavior has merely been transferred to the problem of what constitutes positive or negative stimuli. What stimuli are shocking and what are not shocking seems to be the question. How can the protoplasm of the ameba differentiate between the two types of stimuli? An approach to the answer may be found in the fact that the ameba can learn. In the experiment in which it was fed glass instead of food, it learned but soon forgot. No impression was left on the protoplasm that influenced to any noticeable degree its behavior the next day or the next week. The ameba had "learned" some things, however, that it had not forgotten. The extension of pseudopods is something it had learned and had not forgotten. This activity was learned in the same way that the first breathing of the newborn babe is learned. Extending pseudopods is learned by the ameba as the beating of the heart is learned by the embryo of the human being. These behaviors are part of the basic behavior patterns of the respective organisms, patterned in the process of growth and development. The particular ameba that we observe under the microscope comes by its characteristic behavior as a part of its development. It has come to behave in the way it does as one of a long line of ancestors who acted in that way. Variations there undoubtedly have been among the ancestors of the ameba as there have been among other organisms, but those amebae who did not react appropriately did not become ancestors; they did not long survive if they ran away from food and impaled themselves upon needles. So the ameba that we see draw near to food and away from needles is a descendant of many generations of amebae that have continued to survive because of their positive response to food and their negative response to needles. The growth potentials of amebae are thus seen to mean the character of the protoplasm which through selection perpetuates the ability to extend pseudopods. Through selection the character of the protoplasm is such that it may become organized both for retreat from harmful situations in response to certain quality of stimuli

and for approach to food in response to other qualities of stimuli.

Dominance and Gradients.—Thus it appears that behavior in the amebae is regulated through the dominance of activity in one region of the organism over activity in another region. This dominance comes about through the heightened excitation and the resulting heightened activity of the protoplasm of one region exerted over other regions. The excitation of the protoplasm at the point of stimulation grades off and decreases in its intensity as it is transmitted to other parts of the organism. The activity aroused by the excitation will normally follow the same pattern; that is, near the point of stimulation will be found the point of greatest activity, and it too will grade off and decrease as the distance from the dominant center increases. The pattern resulting from such grading off in the intensity of the excitation and in the degree of activity is known as a *gradient.* The meaning and significance of gradients will be understood if we remember that in behavior some parts must lead and others must follow. The protoplasm of the single cell of the ameba receives the stimulus, transmits the excitation set up by the stimulus, and responds to the excitation. Organisms higher in the animal series have organs and tissues specially constructed to receive stimuli, other tissues for the transmission of excitations, and still others for responses such as we see in muscular activity or in the activity of glands. However different these organisms may be one from another, they are alike in that they can organize their activity to approach food and get away from danger. Although they all have their own ways of doing things, they are in general alike in having parts that lead while other parts follow. In general their patterns of behavior become organized and unified by some parts being dominant over other parts. These organized patterns are gradients of activity, in which some parts lead and other parts follow in a way that maintains the unity of the organism in meeting the situation before it.

Let us examine briefly a few organisms more complex than the ameba to see how they are constituted for control of their activities.

Control of Behavior in the Jellyfish.—The jellyfish is a gelatinous organism that floats on the surface of the sea. Its umbrellalike dome is uppermost and gives the jellyfish its general form. From the lower side of the dome a food stalk extends downward like an enlarged handle from the center of the dome. From the edge of the dome hangs a



Structure of the Jellyfish.

fringelike band which is capable of making rhythmic swimming movements for carrying the jellyfish over food to be taken into the food stalk. From the fringe hang tentacles which carry a primitive form of nerve ending to receive the stimuli from near-by food. Unlike the ameba the jellyfish has different parts to do different things. The main body of the dome serves as the supporting structure for the organism; it does not have the power of movement, and it cannot take in food. These activities are taken care of by parts that are specialized to do their particular work. The characteristic behavior pattern of the jellyfish is a rhythmic swimming activity of the fringe or band which moves it to

food and away from danger. When currents in the water bring particles from near-by food, the special receptors located in the tentacles and in the edge of the band are stimulated and the nerve excitations that are thus set up are conducted to all parts of the band through a network of nerve tissue. This network of nerve tissue is essentially a continuous unit, for each cell branches and the branches grow together to form the unified network.

Like the ameba the activity of the jellyfish is organized as a gradient. A food stimulus coming from one side stimulates the nerve endings on that side and starts the flow of excitations through the network of nerves that will set in action the muscles throughout the whole fringe. The activity of the fringe is graded off, the most active region being nearer the stimulus and the least active region on the opposite side. Thus, the total activity of the organism is patterned into a unified behavior that takes it in the direction of food. Here, as with the ameba, the behavior is organized on the principle that some parts must lead and other parts must follow.

In the ameba a single cell serves as the receptor of stimuli, as the conductor of excitations with the cell, and as the moving tissue. In the jellyfish, these different functions are turned over to specially differentiated tissues. Tentacles dangle from the fringe with special receptor organs to receive the stimuli; the excitations are transmitted by the specialized nerve net; muscular tissue receives the stimuli and sets the jellyfish in motion. The inactive dome gives form to the whole organism, holds it in shape, and helps to maintain the relations of the other parts so that they may do their special work in an orderly manner. Now, with such a diversity of tissues, which shall come first and which shall follow after? The answer is, of course, that the tissue that receives the stimuli and transmits the resulting excitations naturally comes first. The nerve tissue, because it is the more sensitive to stimuli and the more capable of transmitting excitations, dominates the activity of the muscle tissue; the muscle tissue in turn dominates the

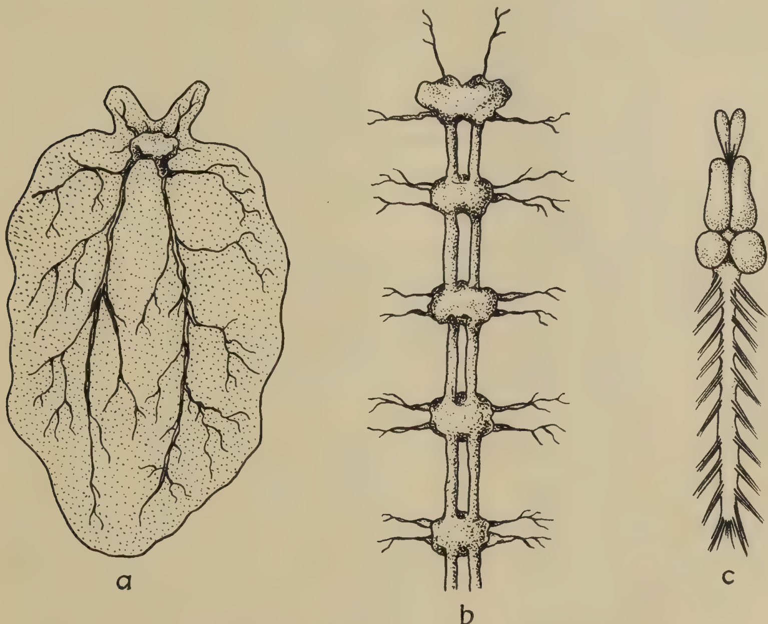
movement of the inactive dome. Nerves act faster than muscles, muscles act faster than the inactive dome; thus the gradient is established that determines the basis for the organized behavior. The nervous system, being the dominant element in this gradient of tissues, becomes the key to the relations that complex organisms maintain with environment. This dominance, however, does not mean an autocracy of one tissue over another; the behavior is a patterning of the whole organism, one tissue supplementing the function of another in a democracy that brings the organism to food and away from undesirable situations. Actually, then, the differentiation of tissues furthers the establishment of gradients. Differentiation in tissues not only leads to increased complexity but also provides the means of maintaining the activity of parts in an orderly whole of behavior. Differentiation determines which part comes first and which follows after in organized behavior.

Gradients Are Systems of Energy.—Gradients, it seems, are essentially systems of energy. They are made up of transmitted excitations and resulting activity of the protoplasm. In the ameba the same protoplasm functions as an organ of excitation and conduction and as an organ of activity that results in the moving of the parts and of the whole of the ameba. In animals with nervous systems the organism is differentiated, the nervous system being specialized in structure and function for the work of receiving stimuli from the world without and transmitting the resulting excitations, while other organs and tissues, such as muscles, bones, and glands, play other roles suited to their particular structure and characteristic activity. The energy represented by the stimulus from without is different in kind from the nervous activity of the transmitted excitation, and both the energy of the stimulus and the energy of the excitation are different from the muscular energy that they ultimately set in action. In man, for example, the rays of light that strike the retina of the eye or the sound waves that strike the ear are different from the

nerve excitations that they arouse. These excitations are entirely different from light or sound; they are nervous energy. In turn, the nervous energy that excites the muscles or glands to activity is a type of energy different from that released by the excitations. Through this cycle, from the light or sound energy of the environment, through the excitations of nerves, to the activity of muscles or glands, it is energy of one type or another with which we deal. Whether we are concerned with an ameba or a man, we find that the behavior is regulated through the dominance of one kind of tissue over another. The behavior is patterned through systems of gradients, which are essentially systems of energy. The kind of energy in one sphere of action makes contact and releases the energy in another sphere of action, and this energy in turn makes contact and releases the activity in a third system of tissues. Such facts remind us again that in studying human behavior we are dealing with behavior patterns which are in their very nature systems of energy.

The Beginnings of Centralized Control.—The flatworm is flat and leaflike. It has a head and a tail, a right and a left side, and an up side and a down side. Unlike the ameba and the jellyfish, the flatworm cannot move forward with the part of the body that chances to be nearest food. It is organized for action from the head down; it moves headfirst toward food and turns tail to danger. This *headfirst* organization of behavior is accompanied by a concentration of the controlling nervous tissue in a pair of large ganglia that lie just behind the mouth portion of the worm. From these ganglia run two branching veinlike extensions of nerve tissue, through the long fibers of which impulses are sent to remote parts of the body. Together with this centralized system, however, there still exists the primitive nerve net, with cells distributed over the surface of the body and interconnected much as they are in the jellyfish. Movements may be set up by the excitation of this nerve net when the central ganglion and its branching connections

have been removed; thus, it appears that there are two independent nervous systems in the flatworm. The central nervous system is seen as a natural accompaniment of the head-tail organization, making it possible to transmit excitations quickly to the more distant parts of the body. The nerve net may rightly be interpreted as a more primitive type of conduction system.



Evolution of the Central Nervous System.
a, the flatworm; *b*, the earthworm; and *c*, the frog. (*c, from S. I. Franz and K. Gordon, Psychology.*)

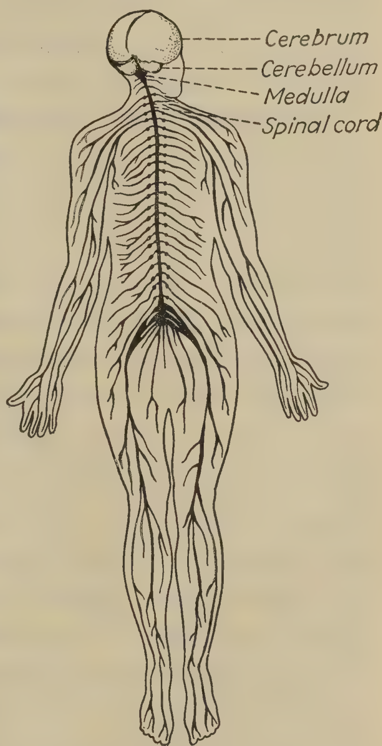
Evolution of the Central Nervous System.—Higher than the flatworm in the evolutionary scale, the earthworm is found to have a more definitely organized central nervous system. Though it is a very simple system, nevertheless in it are found all the essential characteristics of the more complex organizations of the higher animals and of man. In the region of the head there are the two dominant ganglia which are suggestive of the two lobes of the brain of higher

animals. These two ganglia are the first in a double chain of ganglia reaching from the head to the tail of the worm. In each segment of the worm there is a pair of ganglia, connected fore and aft and across with other ganglia of the double chain. In the higher animals this organization is paralleled in the nerve centers within the spinal cord and in the double chain of sensory ganglia outside the cord. These ganglia constitute relay stations through which pass nerve impulses on their way to and from the brain and all parts of the body. Impulses from distant parts of the body can quickly reach the brain through this main highway of nerves, and the system of cross connections along the way makes possible even quicker responses through what we call *reflexes.*

Central nervous systems are typical of all organisms that are axial, that is, organisms that have heads and tails and balanced right and left sides, with pairs of eyes, ears, arms, legs, and ribs. As we ascend the animal scale, the behavior of axial organisms becomes more varied and adaptable. The higher animals are born to do more things and do them better, and they can learn to do still more things and profit by their experience. The development of the central nervous system accompanies this increased complexity of behavior. In man the nerve-net type of controlling nerves is restricted to certain portions of the organism whose activity is essential to existence, for example, to the heart and blood vessels and to the stomach and intestines. Connecting the central nervous system and these organs that are essential to existence is the autonomic system through which their activity is brought into relation to the higher purposes of life.

The Central Nervous System Functions as a Gradient.—The central nervous system is within itself a striking example of a gradient. The head-tail organization determines the nature of the general pattern, the brain being dominant over the centers of the spinal cord, and the spinal centers in turn being in control of nerve trunks. The secondary

centers of the lower brain and the spinal cord, however, possess some degree of independence of function. Examples of behavior regulated through these secondary centers are found in the snatching of fingers from flames, and in the blinking of eyelids at approaching objects. We do these things and think about them afterward. The nerve impulses from the sensory receptors are short-circuited in the spinal cord or lower brain centers to motor nerves appropriate for the fitting reflex response. The sensory impulses thus divided continue to the brain where they become part of a dynamic pattern of complex neural activity which may become the basis of conscious levels of experience.



The Central Nervous System of Man.

The need for this centralized control appears when one views the wide diversity of activities of the human being. He gets into contact with his environment through a wide variety of specialized sensory receptors. These sense organs are intricate arrangements to facilitate the receiving of various types of stimuli, light to eyes, sound waves to ears, contacts to touch, and other types of stimuli through other avenues. The senses of sight and hearing come to play a greater and greater part in behavior, and particularly through the reception of light and sound waves the higher organisms widen the scope of their environment. Man puts great dependence upon these senses, and to nature's inventiveness he has added his telescopes and microscopes, his

telephones and microphones, until he is in touch with the farthest ends of the earth. This increased complexity of behavior is also evidenced in the multiplication of nerve cells which act as connections between near and more distant areas of the organism. The brain of man fairly outdoes itself in the number and variety of cells of the cortex spread over great surfaces of deep folding fissures with inner connections that make possible a unity of action.

Permanent and Temporary Gradients.—The ameba does not have to learn to extend pseudopods, but it has to learn to leave untouched the glass or carbon vibrated near it. It does not forget how to extend pseudopods, but it does forget the lesson of the carbon and glass. In all organisms some forms of behavior are basic and persist as the characteristic behavior of the organism, and the gradients through which such behavior is regulated are relatively permanent. To be sure, some of these patterns are used continuously and there is therefore little opportunity for them to be forgotten, but many others seem to develop and then await the situations that call for their activity. These relatively permanent gradients arise in the course of growth and development of the maturing organism, and though they may be modified to greater or less degree, they remain for the most part stable—the basis for the characteristic behavior pattern which distinguishes one species from another.

In addition to these relatively permanent gradients, there are many others that are less permanent and more easily modified. Jimmie's breathing, his beating heart, and his digestion are of the greatest permanence; his walking and talking, though a part of the basic behavior pattern in their general characteristics, are obviously more modifiable and less permanent. In still other behavior, such as writing, tying his shoes, and combing his hair, Jimmie is even more changeable. Then there are, of course, the hundreds of incidents to which different individuals make their own particular adaptations. Many of these may never be repeated and may leave but little trace because they have little significance to the going concern of life.

The permanence of these gradients is evidently tied up with the differentiation of tissues and organs. The organization of the different tissues and organs makes behavior what it is. Swinging legs and arms, and ribs lifting in breathing are determined by the nature of related nerve, muscle, bone, and other tissues. The characteristic stoop of the shoulders of some classes of workers is evidence of the permanence that may come through continued use. Not only in these more observable kinds of activity is there found this organization of the permanent and the transitory, but likewise in our ways of thinking and in our attitudes toward life there are parts of the patterns that are old and permanent and there are parts that are new. We learn through developing new patterns of thought and behavior appropriate to new situations, and like all differentiation, the new pattern arises as an integral part of the larger pattern of life, remaining as long as it is functional and disappearing when it no longer is.

Organic Democracy.—In the last analysis, control of behavior is effected through the dominance of one part of the organism over other parts, thus patterning the total behavior into a gradient. At first thought, this interpretation may seem to imply an autocratic organization, but actually quite the reverse is true. The simplest organisms are the most autocratic. The one-celled ameba rules its little restricted universe in a definite, exacting manner. Circumstances command it to "pseudopod forward" or "pseudopod rear." It knows not even a "squads right" or a "squads left," and right and left simply disappear into forward and rear as the ameba changes the direction of its activity. The ameba's life represents a simple autocracy. When the single cell becomes so large that cooperative effort is necessary, it divides and creates two new autocracies. On the other hand, as organisms become more complex through the differentiation of varying tissues and organs, there is greater need for cooperation among parts. In the course of development, parts emerge in relation to other parts and they maintain their independence only as they maintain their

relation to the activity of the whole organism. Differentiation does not lead to autocracy, but rather to an organic democracy. The basic law in this democracy remains "All for one and one for all."

As we survey organic life from the ameba to man, we find increased differentiation of tissue and organs and increased specialization of function. As a result of increased specialization, organisms gain a wider range of behavior, an increased ability to adapt to changing conditions in the environment, and an increased capacity to profit by experience. With this increase in complexity through differentiation, the problem of control becomes more complex and there arises the need of more and better organizing of behavior patterns. Added to the basic patterns that regulate mere existence, there appear many patterns that depart more and more from stereotyped response, until on the higher levels we find a remarkable capacity for learning and a remarkable capacity for profiting by experience. Organisms become more aware of what they are about, they become more capable of exercising foresight, the thought processes develop, until in man we find an organism able to project his purposes and plans to the far corners of the earth and into the future far beyond his own lifetime. Thinking and the conscious life, it appears from this survey of the evolution of organic life, arise with increase in the complexity of organisms.

Summary: The Evolution from General to Selective Response.—The evolution of behavior patterns seems to proceed from the general response characteristic of the lower organisms to more highly selective responses in the higher organisms. The ameba organizes its behavior through a gradient of inner excitation and activity in which the same tissue functions in various capacities. The jellyfish organizes its behavior through a gradient of differentiated tissues in which the nerve net dominates the activity of muscles and the inactive dome provides the general form of the organism. The nerve net of the jellyfish is much the same through-

out, and the result is a behavior that varies little in its general character. In the flatworm two systems of conduction work side by side—a transitional state in the evolutionary scale in which the nerve net is retained and the beginnings of a centralized system are introduced. Then, beginning with the earthworm and proceeding up the animal scale, we find that the central nervous system dominates wider and wider varieties of behavior through the organizing of particular behavior patterns that are selected from wide possibilities of response. The nerve-net organization becomes restricted to certain parts of the body which are concerned with the basic activities that are essential to mere existence. The range of adaptation to the unusual in life is widened through the increase in number and types of nerve tissue in the cerebrum, complex in variety and arrangement and highly selective in the manner in which the whole may become patterned for responses. Increase in complexity is also made possible through the development of neural switchboards in the spinal cord and brain, through which control of many levels of behavior is effected. More and more the responses become selective rather than general. Life becomes something more than mere response as the higher organisms are found controlling and creating their own environment in the building of nests and homes, in the storing of food, in protection through social organization of the flock or the herd. Finally, man, utilizing an inventiveness that is astounding, fairly outdoes himself in the manner in which he turns upon his environment and converts its natural resources to his own purposes.

SUGGESTIONS FOR NOTEBOOK AND BULLETIN BOARD

1. Select and organize a series of illustrations to show the operation of the principle of dominance in various organisms. A suitable heading for such a series might be "Some Parts Must Lead and Others Follow" or "Organic Leadership." Both negative and positive types of behavior might be shown.

2. Make a list of illustrations of animals representing different levels in the evolutionary scale, such as the diatom, earthworm, goldfish, frog, owl, ground mole, and cat. Arrange these in sequence along the left margin of your notebook, and with the name of each animal enter captions that point to the outstanding characteristic of the basic behavior pattern. These descriptive captions should represent activities that are common to individuals of each species and different from the activities of other species.

   In separate columns and opposite the illustrations enter words and phrases that indicate the following: (*a*) the relative simplicity or complexity of structure of the different organisms; (*b*) the relative complexity of behavior patterns; (*c*) the relative capacity for selective activity and for learning; (*d*) the relative degree of awareness by the organism of what it is doing.

DIARY OF YOUR OBSERVATIONS

Have you noted in your observations how behaviors are organized in patterns with some parts leading and others following? Make a list of some of those you have observed. The following suggestions indicate possibilities and raise questions.

1. With which foot do people generally lead off after they have been standing? What are the two arms doing in this pattern? The head? After observing several actual cases and possibly catching yourself in the act, try to make an outline of this characteristic pattern, putting first the parts that lead and then the other parts in their order in the pattern.
2. Other questions that suggest observations of walking or skating habits are: (*a*) Do you find that left-handed people start off with the same foot as do right-handed people? (*b*) How consistent are people in this matter, and do you find reasons for the variations in some of the observed incidents?
3. Examine the soles of your shoes and those of others to note evidences of dominance in walking patterns.
4. Note the worn spots in the floor on the turns of stair landings. Observe a dozen or more people to see how the turn is taken on a given landing. Does the same foot generally hit the worn spot? Do people start climbing or descending stairs with the

same foot? Do very young children do the same when they begin climbing?

5. Observe children of different ages writing their names on the blackboard. Note how in the writing of the younger children the whole body becomes actively involved. As the children grow older, which parts are dropped from the pattern first? Which remain as essential in the more highly differentiated pattern of the maturer children?

SUGGESTED READING

1. Chapters 1 and 2 of *Neurological Foundations of Animal Behavior* by Herrick, J. C. (Henry Holt & Company, Inc., 1924) contain material that is helpful in understanding the significance of the relation between differentiation of behavior patterns and selective behavior.
2. A discussion of functional and structural analysis and of whole-part relationship which has much that is pertinent to the discussion in this and the following chapter is found in Wheeler, Raymond, *Science of Psychology*, pp. 8–18 (The Thomas Y. Crowell Company, 1929).
3. In the same volume (pp. 19–25), Wheeler has sketched briefly the history of psychology. This may help to give the reader a background for his study of human behavior.
4. The *New International Encyclopedia*, under the heading of "Embryology," gives a description of the reproduction of the Podophyra which reveals an interesting differentiation even though it takes place in a one-celled organism.
5. The reader will find the following references helpful in getting a fuller acquaintance with the concepts of dominance and gradients: Herrick, J. C., *Neurological Foundations of Animal Behavior*, pp. 54–55 (Henry Holt & Company, Inc., 1924.) Childs, C. M., *Physiological Foundations of Behavior*, pp. 183–184, 206–207 (Henry Holt & Company, Inc., 1924).
6. Interesting material on the behavior of the ameba may be found in the volumes just referred to. See pp. 62 *ff*. of *Neurological Foundations of Animal Behavior*, and p. 59 of *Physiological Foundations of Behavior*.

Chapter Five

Relations with Environment

In the last chapter, emphasis was laid on the way in which different organisms of the animal series maintain their unity of action in the face of increasing complexity. As the organisms become more complex, with more types of tissues engaged in a greater number of specialized activities, unified action is made possible by the development of nervous systems to maintain working relations. In considering this problem of inner control, we set aside for the moment the matter of maintaining relations with environment. It is the purpose of this chapter to round out this picture of organic unity by directing attention to the way organisms make one with environment.

A Broader View of Organic Relations.—The relations that different organisms maintain with their environment vary greatly, vary, indeed, quite as much as do the organisms themselves. If we study the relations of the ameba with environment, we find a simple organism and a simple behavior. Simplicity is relative: the ameba is simple in comparison with the flatworm, the latter in comparison with the fish, the fish in comparison with the frog, the frog in comparison with the bird, the bird with the mole, the mole with the bear, the bear with the chimpanzee, and the latter with man. The record of the ascending scale is written in the basic behavior patterns of the different species and likewise in their capacity for adaptation to environmental changes.

The scale runs through advancing degrees of differentiation and specialization, from the relatively simple to the relatively complex.

The simplicity or complexity of these organisms is matched with a related simplicity or complexity of environment to which these different organisms are able to adapt. The life of the ameba is confined to the restricted environment of the still pond; the fish takes to the open rivers and the sea; the frog lives a life divided between land and water; the wild duck is at home in the air and in the water; the mole takes to devious tunneling in the earth; the bear ranges the wooded hillsides and seeks the protection of rocky caves; the chimpanzee swings from the treetops; man takes off from land to both water and air, bent on the conquest of the elements through the products of his inventive intelligence. Each species has its normal environment that centers about the essential needs of life in matters of climate, shelter, protection, and food supply.

These environments, like the organisms that claim them as their own, represent an advancing scale of complexity—from scummy ponds to moving rivers and the sea, from pond side to higher land, from burrows to dens, from treetops to a fire on the ground and thence to the shelter of houses and to skyscrapers and cathedrals. Up the scale advances the complexity of organic activity, paralleling the complexity of environment to which activity is adapted and over which control may be gained and maintained. To this basic plan of life there opens the possibility of further development, for an ever widening scope of environment awaits the organism that can accept its challenge, and it is the nature of organic life to accept this challenge within the limits of its ability to learn.

Life under Intelligent Control.—It is in this challenging area, in which learning extends the adaptations made by the growth processes, that we face the problem of conscious control. We look at the ameba under the microscope, extending pseudopods toward food and away from needles,

learning that glass is not food, soon forgetting its lesson. As the ameba goes toward food and away from needles, does it know what it is about? Do the frog, mole, bear, and chimpanzee know what they are about as they engage in their respective life activities? Does man know what he is about? These questions may be looked upon from two angles. (1) How intelligent are these organisms; that is, how well can they learn and continue to profit by their learning? (2) To what degree are they aware of what they are doing?

In general the level of the conscious life and the capacity to learn are closely related. Both the level of consciousness and the capacity to learn rise with the increased complexity of behavior and the increased capacity to organize new behaviors. Organisms on the lower levels are more closely restricted to the maintenance of the inner environment and to the related activities of food getting, shelter, and self-preservation, whereas the higher orders of organisms with their increased capacity for learning direct their activities to a much wider range of life. As organisms range further from the usual into the new and novel, the more is learning required and the greater is the demand that organisms be aware and conscious of what they are about. At the top of the animal series is man, with the greatest capacity for learning and with the greatest awareness and consciousness. For the human being the fruits of his intelligence are attained only through years of development.

The Lengthened Period of Infancy.—It seems strange that the highest order of beings should be the most helpless at birth and should take so long a time to become adjusted to the world about them. Doctors who bring many babies into the world are never done with wondering at their helplessness as compared with the young of other animals. The ameba, with the dividing of one cell to make two, takes up a new life with what we might call a *zero period* of infancy. Many fish make no pretense of guarding their eggs, and once hatched the minnows must take their chances for

life in a competitive environment. Tadpoles change to frogs within a period of weeks. The mother bear has new cares each spring, and only for a single summer will she spank her cubs up into trees out of danger. Man's offspring takes years to come to full maturity, and our civilization is so involved that it is becoming necessary to lengthen the period that nature provides in order that youth may be adequately fitted to find his place in our complex life.

In general the period of infancy in the animal series lengthens with the increased complexity of the organism—the more complex the organism, the longer will it take the offspring to mature.[1] The lengthening period of infancy therefore stands in our thinking for increased complexity of organic structure, for more diverse behavior patterns, and for a wider range of environmental circumstances to which the organism is able to adapt. It also stands for an increased ability to manage the environment in the interests of the welfare of the species and for conscious foresight in respect to: food stored and shelter and clothing provided; conveniences in living such as bathtubs, electric lights, automobiles; and the achievements in the arts that add beauty to life.

Levels of Human Behavior.—It is rather startling to think of the number and variety of activities that go on in human beings at one and the same time. The heart beats; we breathe; glands are active; the digestive tract does its varied work; reflexes of the eyes adapt to changing light, clear away dust particles, and make other adjustments; and dozens of other patterns are active in maintaining upright position and balance as we stand and sit and walk. With all these activities going on, we are at the same time free to direct our thoughts and actions into new ways of living. Here is differentiated behavior at its best, with some activities that go on all the time with great independence, others like digestion that are periodic, reflexes that meet hundreds of different minor needs as they arise, and habits

[1] Fiske, John, *The Meaning of Infancy*, Houghton Mifflin Company, 1909.

that blend with these other activities and make them more effective—all combining in the broad foundation from which we make thousands of intelligent adjustments to new situations for which the lower orders of activities are not adequate. This is a complex array of behaviors, all working in unison, all adaptive to the changing conditions of life.

Unintelligent Control of Inner Life.—Nature takes no chances in matters that are essential to continuing life, or at least it tends to reduce the chances to a minimum. The living tissues depend for a continuance of their existence upon an inner environment of blood stream and plasma, and the control of the complex functioning of the physical organism is directed to the maintenance of this inner environment so as to satisfy the needs of different tissues. The activities that are concerned with maintaining this inner environment—such as respiration, the circulation of the blood, the digestion and assimilation of food, and metabolism in the different tissues of the body—are largely self-regulatory. They are directly under the control of the autonomic nervous system, a part of the nervous system that functions independently to a considerable degree. The apparent independence of these activities, however, turns out to be very much an interdependence, an interdependence within the organism that is directed to the maintenance of relations with environment. We shall study some of these activities to get a better understanding of the cooperative unity of life on the autonomic level.

Breathing.—Breathing serves as an excellent example of autonomic activity. The more obvious phases of breathing are centered in the process of getting air into the lungs and getting it out again. Looked at in this superficial way, breathing is not a very complicated behavior; the diaphragm contracts, the ribs are lifted upward and outward by the muscles between them, and in the air flows—first into the mouth and nose, down the trachea, through dividing air passages, and finally to the minute air sacs of the lungs. This process of inhalation and the reverse process of

exhalation, which expels the air from the lungs, are but the more apparent phases of breathing. The first phase of getting air in and out of the lungs is regulated to make possible the second phase, that of getting oxygen into the blood stream and carbon dioxide out. The second phase maintains the oxygen and carbon dioxide content of the blood to make possible the third phase, that of supplying oxygen to the tissues of the body and taking from them the carbon dioxide and other waste products. The need for oxygen varies from time to time with the activity of the muscles and other tissues within the organism, and the concentration of oxygen in the air without likewise varies, thus creating problems of adaptation that make breathing anything but a simple matter.

If there be a tendency to question this unity of the organism and its environment, it can be completely dissipated by noting the types of adaptation that take place when the occasion demands it. The problem of breathing has been thought worthy of a scientific expedition up Pikes Peak, made for the purpose of studying the adaptations in high altitudes. Under normal conditions, changes in the rate of respiration suffice to keep the necessary content of oxygen in the blood, but when one climbs to high altitudes the rarified air creates a problem that cannot be met by simply taking in air faster. Blue lips testify to the lack of oxygen in the blood; activity must be reduced; if you climb under your own power, you must go more slowly. In the course of a few days spent in a high altitude the tissues in the lungs that separate the blood stream from the outer world increase their activity as agents in transmitting oxygen into and carbon dioxide out of the blood, and as a result the climbers are able to exercise in a manner more nearly-normal.[1]

The control of breathing is always directed so as to maintain in the blood stream a relatively stable amount of oxygen, and this implies that the content of carbon dioxide

[1] Haldane, J. S., *Organism and Environment*, Chap. 2, Yale University Press, 1913.

is maintained within certain limits. The autonomic nervous system functions as a control of respiration; under unusual conditions, such as mountain climbing at high altitudes, further adaptations must be made. One of the neural controls depends upon the stimulation of nerves when the content of carbon dioxide in the blood gets too high or too low.

The effect on the nervous system of either too much oxygen or too much carbon dioxide can be plainly seen by simple experimentation. If we continue long without "getting our breath," we will begin to lose consciousness; on the other hand, we may lose consciousness by forced breathing that results in too much oxygen and relative shortage of carbon dioxide in the blood. The nerve center particularly concerned with regulating the rate of breathing is found in the bulb or medulla, the expanded portion of the spinal cord where it unites with the brain. The nerves in this respiratory center do not respond to stimuli from other nerves but are so differentiated that they are stimulated by variations in the carbon dioxide content of the blood stream. When the carbon dioxide content becomes too high, these nerves are stimulated and send forth impulses that accelerate the rate of breathing. When the carbon dioxide content in the plasma becomes too low, the result is an inhibition of the rate of breathing.

The respiratory center in the medulla does not have full control of the rate of breathing. More immediate responses to needs are obtained through pairs of reflex centers which work on the same principle as a windshield wiper. In the muscles of the ribs and the diaphragm are located two sets of sensory receptors, one of which is stimulated at the completion of taking air into the lungs and the other when the air has been expelled. Thus the completion of one phase of respiration starts the next phase.

This organization works as a reflex, but the sensory centers are also connected with the nerve paths of the central nervous system through which come excitations that speed up breathing under such circumstances as thinking of some

exciting experience or being placed in a trying situation. The reflex centers are not sufficient to account for all the respiratory activity, as is seen in experiments with animals which die when the respiratory center in the medulla is removed. To meet the changing needs of life the whole range of regulative control is needed, including: eyes or ears or nose, making the contacts with the outer world to apprise us of the need of action; reflexes that work like windshield wipers; and the more basic center of respiratory control in the medulla.

This sketch of the regulatory organization has been too meager to tell the full truth. Many organs of the body contribute to the maintenance of the balanced content of the blood stream on which breathing control depends. The activity of the muscles results in the formation of lactic acid which, with the carbon dioxide, tends to cause excessive acid content in the blood stream which must be neutralized by the presence of ammonia that comes from the liver. Ultimately, the ammonia and the lactic acid are united in the kidneys as urea and eliminated from the body as waste.

We usually do not include the rate of the heartbeat and the distribution of blood to the various parts of the body as a part of breathing; but since the circulation is essential to bringing oxygen to all parts of the body and taking away the by-products, both the heartbeat and the distribution of blood are necessarily brought into the picture. Rate of heartbeat and rate of respiration work together to maintain the conditions essential to life, and they must work together to meet the changing conditions in the environment.

This whole scheme of regulation is seen in emotional behavior when, for example, we are faced with danger. Under such circumstances the blood vessels of the viscera are restricted, the heartbeat is stronger, the large arteries are restricted, and the blood is forced in greater quantity into the body to bring greater supplies of oxygen and energy-producing materials to the muscles that are called upon to meet the situation. The liver is involved in this

drama as it empties into the blood stream quantities of glycogen as additional sources of energy-giving materials, and the suprarenal glands pour into the blood stream adrenin which sensitizes the muscles and nerves and keys up the whole organism for the emergency at hand.

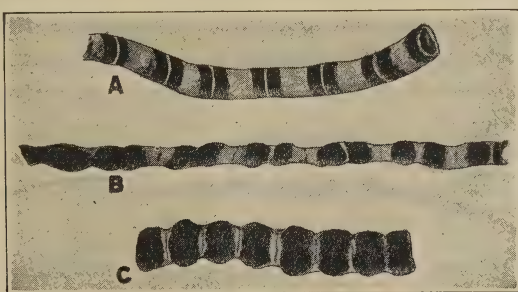
Steady State Is Essential to Life.—Breathing is indeed complex, and it is only one of the complex activities that help maintain a *steady state* in the blood stream. These varied activities maintain a relatively steady supply of oxygen, a steady supply of energy-giving materials, and a steady process of neutralization of acid by-products. The activity of muscles, nerves, glands, and other organs and tissues of the body is made possible by the maintenance of the inner environment, and their activity in turn is directed to establishing the relations with the outer environment that will make possible this steady state in the inner environment.

It thus appears that, throughout the whole range of behavior, our activities in one way or another center in the maintenance of this steady state. The activities of breathing, eating, and protecting ourselves from extremes of heat and cold are obviously in relation to this inner environment, but so too are the highest levels of thought and intelligent action. We are fretful if the air in the room is humid or too warm, and we intelligently regulate heat and ventilation so that we may live in comfort. We are ill because of digestive disorders, and we study dietary rules and replan our food habits to give a better balance in diet. We change our habits of food and clothing to meet the changes of the seasons. Our health is dependent upon the maintenance of the steady state that is characteristic of our species; our pleasure in life and our efficiency in thought and intelligent action are affected by the condition under which nerves and muscles and other tissues of the body function.

Thus at all levels of behavior the business of living is centered in this go-between which unites us in a functional relation with our environment. Life seen from this point of

view is indeed a unity, however complex it may be; behind this unity of inner activity and outer intelligent adjustment to a changing environment lie the dynamics arising from the activities of living tissues.

Muscular Activity.—From the intimate relation of tissues and blood stream let us turn to the activities of some of the larger structures of muscles, glands, and nerves which play a more observable part in our relations with environment. We easily recognize the role of contracting muscles in mountain climbing or sports and in the most common experiences. We are aware that there are muscles of various



Striped Voluntary Muscle.
A, relaxed; *B*, stretched; *C*, relaxed. (*From P. H. Mitchell, Textbook of General Physiology, after Schäfer.*)

sizes and shapes and kinds, each suited to its function. We need only do a bit of casual observation to note the neat arrangements of structural muscles of the arm and hand and the variety of motions that may be made by these members of the body. Hold the right arm before you with the forearm upright, and with the left hand feel the paired muscles on the upper and lower side of the upper arm that are used to maintain this upright position; change the position of the forearm slightly, and note the changes in the balanced relations of the paired muscles. Similarly, examine the muscles in the upper arm and shoulder that are used in holding the arm forward. Move thumb and fingers rapidly, observe the play of tendons in the wrist, and feel the differ-

ent muscles of forearm and hand that are brought into use. Proceed with your survey as you drop the arms to the side in a relaxed state. Now, lay hand on some heavy object, and lift it; then stoop and pick up a pin from the floor; compare these purposeful activities with the rhythmic swing of arms as you walk. This casual survey gives an inadequate picture of the range of activity that arms and hands engage in during a day and a still less adequate picture of the coordinated activities in which the whole body engages, in walking, in lifting a heavy object, in picking up the pin, and in the thousand other experiences of life.

We turn from this brief survey of activities of striped and voluntary muscles to the unstriated or smooth involuntary muscles of the internal organism to complete the picture of the active tissues that dramatize our relations with environ-

Fibers of Smooth Involuntary Muscle.
(*From P. H. Mitchell, Textbook of General Physiology, after Lewis and Stohr.*)

ment. The slower rhythmic action of the intestinal tract is suited to its function of swallowing, of rolling and churning food in the stomach, and of passing the undigested mass along the intestinal tract. The size of arterial blood vessels both large and small, from the great aorta to the smallest capillaries, is controlled by smooth muscles in the walls of these blood vessels. This regulation is an essential part of control of blood supply so that muscles of the structural part of the body are supplied with necessary oxygen and food elements to meet the demands of active engagements with environment and to aid in maintaining body temperature in the face of changing outside conditions. To be sure, one may say that the marvel of this drama lies in the neural control which sets muscles in action, but the greater marvel lies in the organized total of nerve and muscle and

tendon and bone and other tissues which unite to make effective the innumerable activities essential to life.

Muscles contract when they are stimulated, but their response varies with the conditions within the muscles and without. From the blood stream the muscles take the blood sugars and other energy-giving materials that are needed for activity. Within the muscles these materials are transformed into highly unstable chemical compounds which are suited to a quick release of energy through their transformation back into simpler compounds such as carbon dioxide and lactic acid. Muscular contraction depends upon this stored energy, but the muscles must be stimulated before any action can take place. How the muscle fiber receives the nerve impulse and how it contracts depend upon many factors that operate both from within and without the organism. Between the nerve impulse and the major muscular contraction there is what Hill[1] interprets as an intensifying activity within the muscle. As we shall see presently, the nerve impulse on arriving at the muscle generates a chemical which unites with another in the muscle to make a third chemical which starts the major contraction. If the nerve impulse is weak, the intensifying activity may not be initiated and contraction will not occur. When the muscle does respond, the intensifying activity returns to a state of rest before the major contraction is fully completed, and the muscle is thus in a condition to receive further nerve impulses.

How Nerve Excitations Stimulate Muscles.—The brief explanation just given of how nerve excitations lead to muscular contractions does not go far in presenting the different conditions under which this intensifying activity operates. Space does not permit the full story here; a brief outline, however, will give details sufficient for a general understanding that will be quite in keeping with our

[1] Hill, A. V., *Adventures in Biophysics*, p. 134 *ff.*, University of Pennsylvania Press, 1931.

purposes. We shall first present a series of statements of facts and then give an explanation of what happens when nerve stimulates muscle. Our outline is based on studies of autonomic nerves upon smooth muscles.[1]

1. Some muscles will contract when stimulated by one set of nerves and relax when stimulated by another set of nerves.

2. The same set of nerves will cause contraction in one muscle, such as the heart, and relaxation in another muscle, such as the intestines. Another set of nerves will have the reverse effect upon the same muscles.

3. Many of the muscle fibers are not supplied with nerve endings; the contraction of these fibers seems to depend upon the action of a chemical intensifying agency that comes from fibers that *are* supplied with nerve endings.

4. The actual contraction of smooth muscles seems to be much the same; therefore, the differences noted above seem to be caused by the nature of the intensifying chemical activity that takes place between the action of the nerve ending and the response of the muscle.

5. One cue to what happens in the intensifying period is the fact that muscles may be contracted and relaxed by chemical agents introduced into the blood. Adrenin, from the suprarenal glands of the kidneys, acts upon some muscles as a stimulant for contraction, and in other muscles it leads to relaxation; other chemicals relax the heart and contract the intestines. Thus we find different chemicals introduced in the blood stream acting on muscles somewhat as do different types of nerves.

6. The chemical nature of what happens in the intensifying period is definitely indicated by experiments in which stimulation of the muscles of a frog's heart by sympathetic nerves leads to the formation of a chemical stimulant, which will cause contraction in another frog heart.[2] This chemical

[1] Cannon, W. B., and A. R. Rosenblueth, *Autonomic Neuroeffector Systems*, p. 98 *ff.*, The Macmillan Company, 1937.

[2] *Ibid.*, p. 23.

agent is like adrenin in some respects but unlike it in other respects; it acts like adrenin on some muscles but has an opposite effect on others. Since it leads to the same reactions as do the sympathetic nerves it has been called *sympathin*.

7. The attempt to account for seemingly contradictory behavior in different organs has led to the theory of two sympathins, one that is excitatory and one that is inhibitory. Sympathetic nerve stimulation in the region of the liver seems to generate only the excitatory sympathin, whereas in the intestinal region and the heart both the excitatory and the inhibitory sympathins are formed. Sympathin arises, it is supposed, from the union of a chemical *mediator* liberated by nerve action and a *receptor* chemical peculiar to the particular muscle. Receptors in different muscles differ, and thus the products of receptors with mediator differ; the two types of sympathin thus formed account for the fact that the same set of nerves may stimulate one muscle to contraction and another to relaxation.

The stimulation of muscle fibers that are not supplied with nerve endings remains to be accounted for. The best present explanation for this seems to be that sympathin acts upon the surfaces of the cells so that the *mediator* passes easily from one cell to another. Entering adjacent cells that do not have nerve endings, it unites with the chemical receptor in those cells and forms sympathin, and this stimulates the cells to contraction.

Many complex situations seem to be satisfactorily explained by the theory of two sympathins. The significance of the theory for our purposes lies in the fact that we can now see that many of the determining factors of behavior are to be found rooted in the characteristic behaviors of different tissues. It is important that we understand the kind of control that comes from the activity of the human brain in consciously directing the larger affairs of life, but there is great need of understanding that the foundations of these higher orders of activity are rooted deep in the

cells themselves. It should be plain that the scope of the basic activities is such as to challenge our attention and serious consideration.

In the light of such understanding we are able better to understand the results of many experiments on muscles in action. These experiments show that the character of muscular response is not stereotyped; it varies with the conditions of the internal environment, duration of the nerve impulse, speed of contraction, degree to which it has already contracted, relation of present stimulation to previous stimulation, amount of load lifted, and duration of the activity. In other words, muscular activity is part of a greater whole; not only does this larger whole include the relations of muscles with nerves and the inner environment of blood stream and plasma, but muscular activity varies with the work to be done as the organism maintains relations with the outer world.

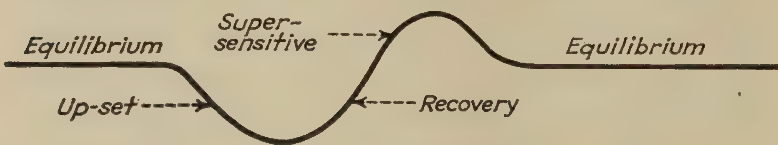
Glandular Activity.—The activity of glands as a part of emergency experience has already been mentioned. Further study shows that glands play an important role in maintaining the inner environment in a steady state. The nature of glandular activity varies with the particular gland, but in general the tissues of the glands select from the blood stream certain materials which are recombined into new compounds. These products may be returned to the blood stream as conditioners for the growth and activity of other tissues of the body, they may be used in the process of digestion, or they may be eliminated as waste material. For example, there is the action of the liver in secreting ammonia and in converting digested starches and sugars into glycogen which the liver stores as a ready supply of energy for emergencies; there is the secretion of adrenin by the adrenal glands of the kidneys, a secretion that plays an important part in facilitating and stepping up muscular activity in emergencies; there is the secretion of saliva and other digestive fluids; there is the secretion of perspiration which serves as a mode of elimination of waste products and

a means of maintaining body temperature. These and many other glandular activities are integral parts of the larger life of the organism, making essential contributions to the varying activities that are necessary for adaptations to changes in the environment. In the next chapter we shall consider more fully the part taken by the ductless or endocrine glands.

The Nature of the Nerve Impulse.—As shown in previous chapters, the nervous system leads other tissues in the growth of the human organism, and through its ability to transmit nerve impulses it continues as the dominant and directing instrument in human behavior. The sense organs are highly organized avenues of contact with what goes on both within and without the organism. There is no movement of the structural muscles of the body that does not find sensory organs (embedded in the cartilage of joints and in the strands of ligaments, tendons, and muscles) ready to initiate the nerve impulses. These sensory impulses of motion unite with other impulses from sense organs of the eyes, ears, skin, nose, and mouth to form the complex neural pattern in which our relations with environment are interpreted. Before we turn to the consideration of the sense organs, let us study the nature of the nerve impulse itself.

Nerve impulses seem to arise from the upsetting of the equilibrium existing between the electrical potentials on the inner and outer surface of the sheaths that cover the nerve fibers. When the equilibrium is upset at one point on the nerve, adjoining areas are affected and the upset progresses along the fiber much like the progress of a blaze of gunpowder which has been strung in a line and touched at one end with a lighted match. The nerve impulse may also be compared with a row of dominoes standing on end; when the first domino is pushed over, it topples the second, which topples the third, the others being brought down in quick succession. The presence of balanced electrical potentials on opposite sides of membranes is a phenomenon commonly found in experimental work. It is generally considered that

these potentials are built up by the separation of positively and negatively charged molecules, the smaller molecules passing more readily through the tissue membranes, leaving the larger ones on the inner side. Having become separated, the molecules are held in a state of equilibrium by the attraction of their positive and negative charges. This equilibrium may be upset in several ways. Contact or pressure may disturb the equilibrium by drawing off some of the positive charge or may change the permeability of the membrane, thus bringing the positive and negative charges together. The equilibrium may also be upset by chemical action or sudden changes in temperature. The changes in the equilib-



THREE PHASES OF NERVE IMPULSE.

The diagram represents three phases of the nerve impulse: the upset of the equilibrium of the nerve at rest; the recovery period in which the potentials are rebuilt; the supersensitive period preceding the return to rest.

rium of one nerve may upset the equilibrium in an adjoining nerve and thus initiate nerve impulses in the second nerve.[1]

During the rebuilding of equilibrium following a nerve impulse, there are some interesting possibilities of interrelation of activity with other nerves. Following a nerve impulse the equilibrium is again built up and the nerve restored to a state of rest. This process of coming again to a state of rest might be likened to setting up a row of dominoes after they had been toppled over. During the first part of the period of rebuilding, the nerve does not possess the normal sensitivity it has during the state of rest, and stimuli must therefore be of greater intensity to result in an impulse. In the latter part of the process of rebuilding, something in the nature of momentum is gained, so that in the period just preceding the return to a state of rest the nerve

[1] Adrian, E. D., *Mechanism of the Nervous System*, pp. 19 *ff.*, 29, University of Pennsylvania Press, 1932.

is supersensitive to stimuli. Turning to the dominoes again, we may liken the supersensitive period to a domino that in being replaced on end has swung beyond the upright position and as it returns may be toppled over with a slight additional impulse.

Another interesting phenomenon is the summation of stimuli. If the first domino is at rest, a slight push will set it in motion but may not topple it over; but if several such pushes are given it at regular intervals the domino will topple over. In the same manner, subnormal stimuli, if repeated at close intervals, will pile up or summate their influence on a nerve at rest and initiate an impulse. Thus, it appears that one nerve impulse may start impulses in a second nerve by subnormal excitations if these come in the supersensitive periods following previous impulses or if subnormal excitations are repeated and summate sufficiently. If the second nerve is in the first phase of recovery, however, the combined impulses from several contacting nerves may be necessary to set up an excitation. These properties of stimulation and recovery of nerves are undoubtedly some of the factors that are responsible for the rhythmic behavior that characterizes much of our life. Another factor seems to be the chemical changes which are set up by the nerve when it stimulates other tissues.

There is little variation in the nature of single impulses of a given nerve, single impulses following what is known as the *all-or-none* law. This means that, if a stimulus will initiate a nerve impulse at all, it will initiate a full impulse; that is, if the equilibrium of electrical potentials is upset, the upset occurs all along the nerve, just as the toppling of the first domino will bring down the whole line. The all-or-none law does not mean, however, that there is not a wide variation in the activities of nerves. The intensities and durations of stimuli upon the sensory end organs vary; as a result, the number of nerve fibers that are affected vary; and each fiber may vary in the frequency and duration of the impulses.

The experimental evidence on what takes place in the complicated structures of the brain points to this region as a field of activity that gives rise to changing electrical potentials for the brain as a whole.[1] These changing fields of potentials vary with the changing life of sleep, rest, and other activities. One report[2] points to the possibility of there being fairly well-organized paths of activity between the midbrain and the cortex; these have been suggested as the basis for consciousness.

The implications of our study of the nerve impulse are important to our understanding of the basis of mental activities, but before we consider these let us broaden the picture by a survey of the sensory organs.

Sense Organs.—We are so well acquainted with many of our sense organs through the use to which we put them in everyday life that we may wonder why we should devote time to their study. Yet there are good reasons for doing this. Many of our notions of sensory activity are so superficial and even so erroneous that we find our interpretations of our experience as a whole warped by these too easily formed notions of how eyes see, ears hear, noses smell, and the like. Then, too, we may not be conscious of the significance of certain sense organs simply because they are not so apparent as some others that obtrude upon our consciousness; thus, eyes and ears are so apparent that we may forget the kinesthetic sense organs that lie hidden in joints, tendons, and muscles. Then, again, we may have some queer ideas of just how much of the experience of seeing takes place in the eyes, how much of hearing goes on in the ears, of smelling in the nose, of tasting in the mouth, of touch

[1] Jasper, H. H., and H. L. Andrews, "Human Brain Rhythms," *Journal of Educational Psychology*, Vol. 14, pp. 98–126, 1936.

Loomis, A. L., E. H. Harvey, and H. G. Hobart, "Electrical Potentials in the Human Brain," *Journal of Experimental Psychology*, Vol. 19, pp. 249–279, 1936.

[2] Rundles, R. W., and J. W. Papez, "Connections between the Striatum and the Substrantia Nigra in a Human Brain," *Archives of Neurology and Psychiatry*, pp. 550–563, 1937. See *Time*, Jan. 24, 1938, for brief review in section on "Science."

in the fingers. These end organs are most assuredly essential to these conscious experiences of seeing, hearing, smelling, tasting, and feeling; but it takes more than end organs alone to make conscious experience. In later chapters we shall give attention to the nature of conscious experiences, and we shall then see, better than is possible at this time, that much more than the activity of nerves in end organs is involved in it.

So we proceed with our examination of the sensory end organs reserving for a later time the study of the nature of the conscious experience in which eyes and ears are used to see and hear. We will remember that we are studying *end organs*, the presumption being that these are indeed but the avenues through which the organism makes contacts with the world outside and with its own varied activities. At this time we will center our attention upon the way in which each different sense organ is able to make contact with its particular type of stimuli. This is a most enlightening aspect of our present theme of environmental relations, and we may well marvel at the unique arrangements of bone, cartilage, tendon, muscle, and other tissues that carry to carefully arranged nerve endings the stimuli of light waves and sound waves and the more substantial contacts made through the skin, nose, and mouth. The sensory nerve endings that make contact with inner activities are simpler structures but are differentiated in a manner appropriate to their function. We shall start our study with the sense organs that play important parts in maintaining the unity of the inner organism.

The Kinesthetic Sense Organs.—The nerve endings of motion are, for the most part, located between bands of muscles and tendons and ligaments and upon the surfaces of joints. Few or no specialized mechanical devices (such as the lenses in the eyes or the eardrums) are to be found with the nerve endings, the ends of nerves dividing and terminating at points where the activity of the muscles will lead to stimulation through pressure upon the nerves.

It should be apparent that the kinesthetic nerves must play an important part in the control of activities of many kinds. Controlled coordination of behavior patterns could not exist without the end organs and sensory nerves which pick up the evidence of muscular activity and transmit it back to the central nervous system. These patterns of behavior are balanced activities of muscles counteracting one another in paired relations. Maintaining posture, reaching, grasping, and other behavior patterns are activities that are not stereotyped but adjusted in their niceties in the course of action. The kinesthetic nerves give evidence of things done within, of muscles contracting, pulls on ligaments and tendons, weights and pressures on joints, and these sensory cues join with cues from eye and other sensory organs to give needed guidance for modification of the pattern to meet the particular situation with which the organism is confronted.

Closely related in function to the kinesthetic end organs in the skeletal part of the body are the organs of balance and motion and muscle tonus located in the semicircular canals of the ear. Consideration of these at a later time will help in understanding the reciprocal relations of muscles stimulated to action by motor nerves. We shall also find that the sensory cues from kinesthetic nerve endings play an essential part in adjusting other sense organs for the receipt of stimuli.

Sense Organs of Touch, Pain, and Temperature.—The end organs of pain, touch, and temperature are distributed in varying degrees of concentration over the surface of the body and in the mouth, nose, and throat. Whether there are pain "spots" within the body is a question, but there is no doubt that pain arises from the excessive stimulation of nerve endings of all kinds. Overstimulation of the end organs of the eyes and ears with bright lights and loud sounds causes pain; gases and materials taken into the nose and mouth may likewise be painful; and stomach ache is unmistakable whether it arises from differentiated end

organs of pain or from kinesthetic sensory endings that are overstimulated by the contractions of stomach walls. Various types of end organs of touch are spread over the surface of the body; and if we consider the kinesthetic end organs as organs of touch and pressure, we may say organs of touch are distributed throughout the body. Nerve endings of temperature are well distributed on the body surface, and a quickly swallowed glass of water or mouthful of ice cream gives rise to stimulation within the stomach that indicates that there may be some end organs of temperature within the visceral organs.

For purposes of interpretation, it is well to consider these various end organs of contactual stimulation in a group, in contrast to eyes and ears which are more highly differentiated for the reception of sound waves and light waves from environment more or less distant. Thus, the avenues of close firsthand contact are dependent upon these more primitive end organs. As will be noted in later chapters, we need experience that involves more of these contacts of touch and doing to give balance to our lives; we depend too greatly on eyes and ears, particularly in the early stages of learning.

The mechanical arrangements for bringing the stimuli of things touched and pressed and things cold and hot into relation with nerve endings, present some interesting variations. Nerve ends are coiled about the roots of hairs so that the excitation varies with the way the hairs are touched. Touch corpuscles of various shapes provide arrangements of the nerve endings within structures of connective tissues that are pointed to the skin surface so that varying degrees of stimulation give rise to excitation of different nerve endings within the same corpuscle. Some of the corpuscles are located deeper in the surface tissues than others, and some of them seem to be constructed to resist all but the heavier contacts by burying the nerve endings within masses of connective tissues. The number of corpuscles located in different portions of the body varies

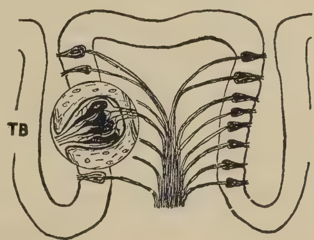
greatly, as one realizes when the sensitivity of lips and fingertips is compared with that of other parts of the body surface. Five times the number of pain spots are found on the surface of the neck as on the soles of the feet. Pain spots indicate the presence of specialized end organs of pain, as cold and hot spots indicate specialized end organs of temperature. The term *spot* refers to the areas, experimentally located on the skin, that are sensitive to different types of stimuli.

Stimulation of these end organs is not an open-and-shut matter, but one of variation. Nerves accomodate themselves to changing conditions, as is evidenced when we continue to press upon the same spot, persist in lifting a weight, or find that water that seemed cold may seem warm after our hands have been in ice water. We need only turn back and note again the nature of nerve action to see that what takes place in nerve stimulation is very much a relative matter. It will become more apparent as we proceed that the effect of the nerve impulses from these end organs in excitations of other nerves of the cord and brain is likewise a relative matter.

End Organs of Taste and Smell.—Food and air are essentials of life, and it is fitting that the organism should protect the avenues through which these essentials are taken into the body; this is one of the functions of the end organs of taste and smell. The end organs of smell are located in the upper part of the two air passages of the nose. The areas of specialized sensitivity are each no larger than a thumbnail. The mechanical arrangement of tissues is very simple, with the nerve endings interlaid with the cells of the surface membrane which are elongated and divided. The nature of the stimulation is for the most part chemical, the particles of solid materials and the gases carried by the air acting to set up nerve impulses in the end organs. These cells are differentiated for the reception of this type of stimulus; they would be of little use in the eye or ear. Our everyday experience gives some indication of the variety

of stimulation that may take place in these nerve endings. We find one odor dominating another or odors neutralized when experienced together; and we find two odors blending to make a new odor. To be sure, we depend upon learning for these experiences to have their values in our individual lives, but beneath the values lie differences in the kinds of nerve stimulations which make the varied experiences possible.

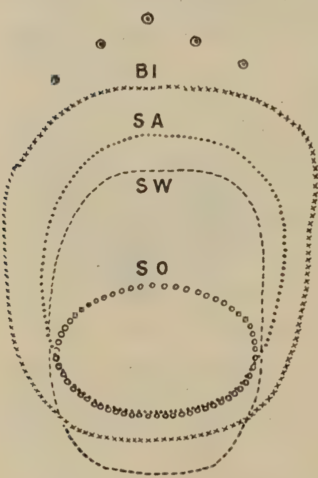
Taste and smell are often so intimately related that we may mistake one for the other. Onions are more smelled than tasted, as are many other foods that we have come to think of as being chiefly tasted. But we see the difference when we have a cold in the head that puts the end organ of smell out of operation. We commonly combine more than taste and smell in our enjoyment of or aversion to foods; the crunchiness of nuts as compared with the smooth feel of ice cream and the difference between wilted and crisp lettuce point to touch, kinesthetics, and yes, even the auditory, as component origins of sensory experience in the matter of eating.



A Papilla of the Tongue. The encircled area shows a taste bud magnified. (*From S. I. Franz and K. Gordon, Psychology.*)

We can taste only substances that are in solution. The solutions come in contact with the nerve endings on the surface of the tongue by dropping into the moats that surround the tiny papillae, or raised portions on the tongue. The end organs occur principally in the form of taste buds found distributed on the top and the sides of the papillae. The name *buds* is in keeping with the shape and structure of the end organs; leaflike cells form the main structure, shaped like a bud, with a pore opening to the surface of the tongue and forming the axis of the bud. A nerve entering the base of the bud divides and extends some tendrils to the surface of the pore, and other tendrils make contacts with other nerves within the bud.

In the newborn babe, it is to be noted that the nerve endings are distributed over the whole tongue and that in the course of time the front third of the tongue loses the function of taste except upon the edges. It is hard to say just how far the difference in function of the nerves of the babe has proceeded at birth; but we know that in the adult the rear of the tongue is best differentiated for bitter tastes, the tip of the tongue for sweet, the sides for sour, and taste buds responsive to salt are distributed over the tongue. The accompanying taste chart shows the larger areas that are more or less sensitive to these different substances. Some papillae seem to contain nerve endings susceptible to only one type of stimulus, whereas others may be excited by two, three, or even four of the basic stimuli. All of which is in keeping with the wide range of pleasant experience that may come from eating.



Taste Chart of the Tongue's Surface.
BI, bitter area. *SA*, salt. *SW*, sweet. *SO*, sour. (*From S. I. Franz and K. Gordon, Psychology, after Schreiber.*)

The character of impulses going to the brain depend upon many factors: (1) Nerve endings located on different areas of the tongue are responsive to different stimuli. (2) Provision is made in the taste buds for interaction of nerves. (3) There are the differences in intensity, arising from the number of nerve endings being stimulated and the frequency of successive nerve stimuli over different nerves. To these factors there must be added those that are determined by the activity of the brain.

Organs of Hearing and Sight.—Sound and light may come from a distance, and through the eyes and ears our relations to environment are greatly extended. We soon

learn to depend upon these sense organs for much of our experience, and we may easily forget that what we see and hear are many times things we have first understood because they were tasted, smelled, touched, and handled in significant situations. This interdependence should serve to remind us that seeing, hearing, tasting, smelling, touching, and conscious doing are mental experiences: they are what we have come to *understand;* they are what we have made out of the raw materials that come from the nerve endings in the sense organs. In another chapter we shall consider more carefully the development of conscious experience in the early life of the individual, but the reader may foresee from our present discussion that it is through the interplay of central neural patterns that our experiences mount to the mental level. It is through the development of neural patterns created in the activity of the brain that the human organism comes in the course of its early development to find meaning in his experience.

The mechanical arrangements in eyes and ears for bringing stimuli to nerve endings are much more complicated than in other sense organs; sound and light waves require in their very nature more refined mechanisms. Even so, in eyes and ears we find a persistence of the principle of differentiation that operates through the mechanical arrangements and through the specialization of nerve endings. It is through these differentiations that varied stimulation is made possible, and through varied excitations the brain centers rise to a complexity of activity adequate for conscious experience. It is mankind's capacity for combining the excitations from many sense organs, one giving leverage to another in a complex neural pattern, that is the foundation of mental levels of experience. It will become clearer as we proceed that meaning is largely read into our experiences; only a low order of meaning is guaranteed by the unlearned patterns that indicate something seen without knowing what can be done about it, something heard without knowing what bearing it has upon life.

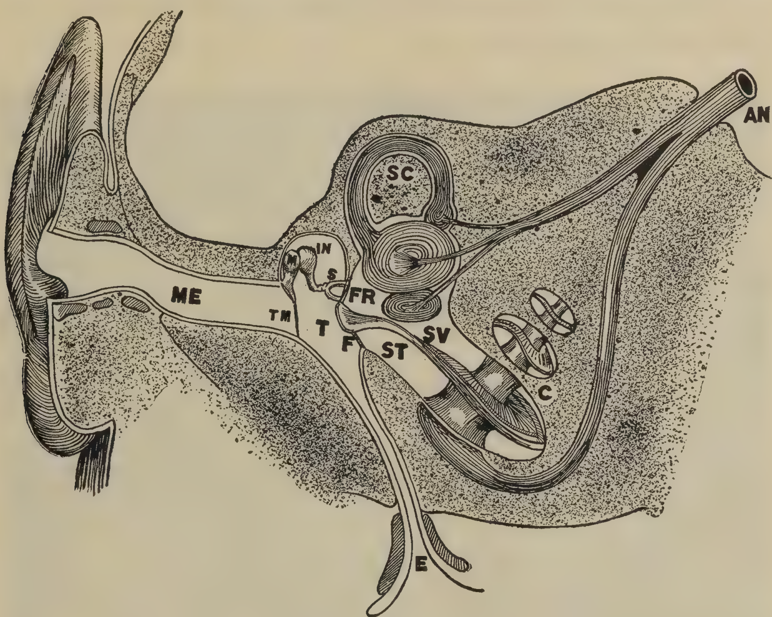
The range of stimulus to which these organs are sensitive is limited. The nerve endings of the ears of young people are responsive to sound vibrations as low as 20 per second and as high as 22,000 per second; by middle age the upper limit has been reduced to about 15,000 vibrations per second. The nerve endings of the eye are responsive to only a very narrow band of the rays of light that come from the sun.

Adaptive Mechanisms of the Ear.—The external part of the ear serves to catch the sound waves and set into vibration the air in the passage leading to the eardrum. The eardrum and the middle and inner ear are fairly well protected from accidents since they are located well within the bony structure of the head. The cavity of the middle ear, which lies just inside the eardrum, is filled with air, the air pressure on the two sides of the drum being equalized through the Eustachian tube which runs to the upper throat cavity. Sound waves striking the eardrum are carried across the middle ear through a set of three bones, the hammer, anvil, and stirrup. These three tiny bones are attached to the bony walls to form a system of levers, moved at one end by the vibrating eardrum which is joined to the end of the hammer handle and carries the vibrations to the other end; there the foot of the stirrup fits into the little oval window through which the vibrations are carried to the liquid that fills the inner ear.

It would be a mistake to think that the action of the system of levers of the middle ear is a purely mechanical affair, for at each end of the system tiny muscles act in balanced relation to control the character of the vibrations that are taken from the eardrum and delivered to the internal ear. This modification of original sound waves is the first step in the differentiation of the raw stimuli that come to the ear; it is the first evidence that hearing is what we make of the raw material of the sound vibrations in the outer-ear passage. The vibrations are modified by the shape and structure of the eardrum, by the adaptive activity of the muscle attached to the hammer near the drum, by the

leverage of the bones and the cartilaginous connections of one bone to the other, by the adaptive activity of the muscle attached to the stirrup near the oval window, and by the character of the membrane covering the oval window.

When the vibrations are brought to the oval window, they are transmitted to the liquid of the vestibule of the



Cross Section of Ear.

ME, outer ear; *TM*, eardrum; *T*, middle ear; *M*, *IN*, *S*, hammer, anvil, and stirrup; *FR*, *F*, membrane-covered windows; *SV*, vestibule; *C*, cochlea; *SC*, semicircular canal; *E*, Eustachian tube; *AN*, auditory nerve. (*From P. H. Mitchell, Textbook of General Physiology, after Czermak.*)

inner ear by the movement of the foot of the stirrup and the membrane that holds it in the window. Leading off from the vestibule on the side opposite the oval window is the cochlea, the part of the inner ear that is most concerned with hearing; it is shaped like the shell of a snail, a bony spiral encasement only ¼ inch long, winding 2½ times about a central axis. Three semicircular canals also lead off from the vestibule; these canals are concerned with body

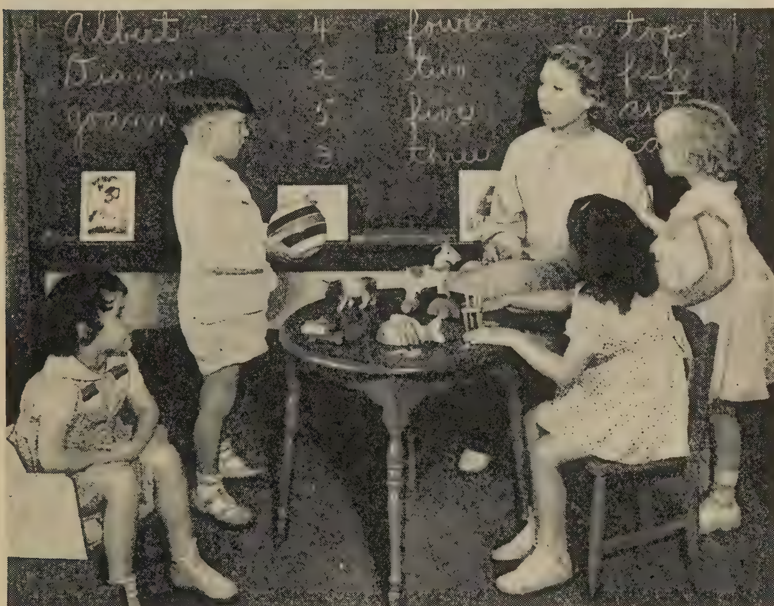
movement and balance and muscle tonus. All parts of the inner ear are filled with liquid, the medium through which vibrations, pressures, and movements of the liquid itself excite the nerve endings. Vibrations of this liquid would be difficult to conceive if it were not for a second round opening whose membranous covering separates the middle and inner ear. This membrane gives some freedom of movement to the liquid of the inner ear.

(*Courtesy of Los Angeles Public Schools.*)

When hearing is gone, speech finds a guide in the sense of touch.

Several theories have been advanced as to how some of the many nerves of the ear may be stimulated and some not, to account for the wide range of tones and combinations of overtones that we learn to enjoy in music. The placement of the nerve endings upon delicate membranes points to the possibility of the membrane acting as a resonator vibrating in segments and thus stimulating in varied manner the nerves in its different areas. Another interpretation is

suggested by the fact that the nerve endings are located, for the most part, at the base of epithelial cells that extend hairlike processes into the liquid of the inner ear. Some of the hair cells are confined within small membranous enclosures, and some rest on one membrane and extend the hairs through a second membrane. Thus, it appears that the nerves may be stimulated by the activity of the hair cells which have been set into vibration by the liquid directly



(*Courtesy of Los Angeles Public Schools.*)

Sight takes the place of hearing when children learn to read lips.

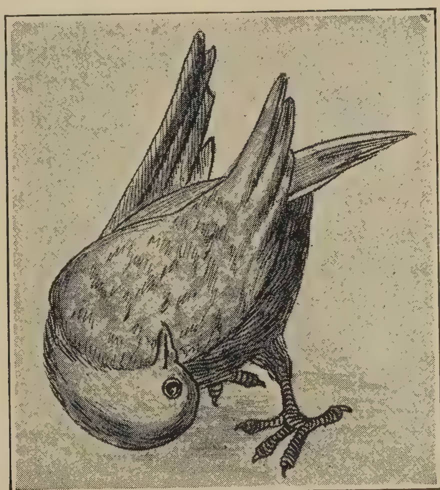
or indirectly through the vibrating membranes. Suffice it to say that there are differences in location of the nerve endings and in the mode of stimulation, and these differences provide the basis for a wide variety of combinations of neural excitation. Added to these mechanical features, there are undoubtedly differences here, as in other sense organs, in responsiveness of the nerves themselves to different stimuli. The stimulation does not in itself guar-

antee the auditory experiences, for here as in other sense organs it is what we make of the raw material that counts. There are differences in human beings, in ear structure and in sensitivity to stimulation, but there are likewise great differences in what different people make of their hearing. It may be years before an individual discerns the two voices in a duet; it may be many more years before he becomes responsive to the intricate tonal patterns of an orchestra so that they come to mean something of beauty to him. We may have learned early to use the two ears and to turn the head to locate where a bird is singing, but we may still know little of the differences in the songs of birds. We may know what people mean when they tell in prosaic language of practical things, and still be unresponsive to the tonal and rhythmic patterns of poetry that add to the meaning of the words themselves. In short, nature provides in the mechanical and neural arrangements of the ear the avenues through which we may make remarkable adjustments with our environment, but these potentialities must be translated into the experiences and purposes of the individual if they approximate their possibilities in making life more adaptable and satisfying.

The Function of the Semicircular Canals.—Leading off from the vestibule of the inner ear are three semicircular canals, each about 1 inch in length and about $\frac{1}{20}$ inch in diameter. The canals are more nearly two-thirds of circles than half circles as their names signify. The three canals of each ear are located in planes at right angles to each other, and the respective perpendicular canals on the two sides of the head are at right angles to each other. Nerve trunks run to these canals and end in membranous tissues, which extend hair cells into the liquid of the canal. At the base of many of the hair cells and close to the nerve endings are found small calcium particles.

The stimulation of the nerve endings comes with the movements of the body and head. The up and down, forward and back, and right and left and the hundreds of

combinations of these relations to environment result in the stimulation of many nerve endings through changes in the pressure and with the movements of the liquid in the canals. The body moves and the liquid of the canals tends to stay where it was, and the movement results in differences in pressure or in actual movements of the liquid in the canals. Hair cells are acted upon by these circumstances and the inertia of the calcium particles at the base of hair



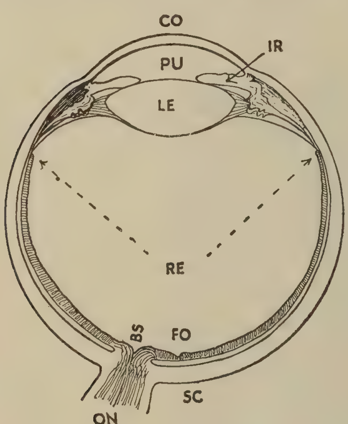
Bird with Injured Semicircular Canals Loses Sense of Balance. (*From P. H. Mitchell, Textbook of General Physiology, after Ewald.*)

cells accentuates the effect of their movement, and thus stimulation of nerve endings follows.

Control of body position and movement in common experience involves more than the semicircular canals. Eyes give evidence of changing relations of things seen, ears of things heard, end organs of touch of things felt, kinesthetic end organs in muscles, tendons, ligaments, and joints of activity within the organism; and to these are added the excitations from the semicircular canals. Experimental data give unmistakable evidence of the important part that the end organs of the canals play in the control of balance and movement. Muscle tonus is likewise dependent upon the

flow of excitations from these end organs to the midbrain. Muscles act continuously in balanced relation of pairs or in more complex patterns to maintain posture in waking hours, and even in sleep there are varying degrees of relaxation of the whole organism. In this scheme of things the neural mechanisms of the canals play their part.

Adaptive Mechanisms of the Eye.—The eyes as instruments of stimulation are quite as marvelous as the ears. They deal with light waves, instead of sound waves and pressure and movements of liquids, and are therefore quite different types of mechanical and neural organizations. Light from the sun or from artificial sources is reflected to the eye from objects upon which it falls; some light is absorbed by the object, resulting in high lights and shadows of different intensities and in color being reflected to the eyes. As the rays strike the curved surface of the eyeball, they are bent and then bent again as they enter the liquid in the fore part of the eye. The iris curtains out many of the rays, regulating the amount passing through to the working limits of the nerve endings on the retina inside the eyeball. The rays that pass through the pupil are refracted again by the lens lying just behind the iris. The lens is adaptable; it is held in a mesh of connective tissues which join at its edge with small muscles. Adjustments of the thickness and contour of the lenses are made by the contraction of these tiny muscles so that images of things near or far may be brought into clean-cut outline upon the retina. To be sure, the image is upside down, and right is left, and left is right; but that matters little, for in the process of reading meaning



Cross Section of Eye.
CO, cornea; *IR*, iris; *LE*, lens; *RE*, retina; *FO*, fovea; *BS*, blind spot; *ON*, optic nerve. (*From L. I. Franz and K. Gordon, Psychology.*)

into the excitations the data from other end organs will unite with them and things will be put aright in our experience.

Thus we see the eye as a living camera. The iris is the diaphragm, the eyelids are the shutters, the lens changes shape instead of moving backward and forward as in the commercial camera, and the retina is the sensitized film upon which the image makes its impression; both cameras register an upside-down, right-to-left image that must be reinterpreted to conform with other evidence of experience. The commercial photographic film must go through a process of development and reinterpretation to make the negative, and then from it the positive picture is printed. The images on the retina in black and white and colors of reflected sunrays must likewise undergo transformations as excitations in the retina are relayed to the midbrain and to the cortex. In the brain these images "develop" into meaningful experience through their union with the going stream of life which brings the present sensory experiences under the interpretive influence of past experience.

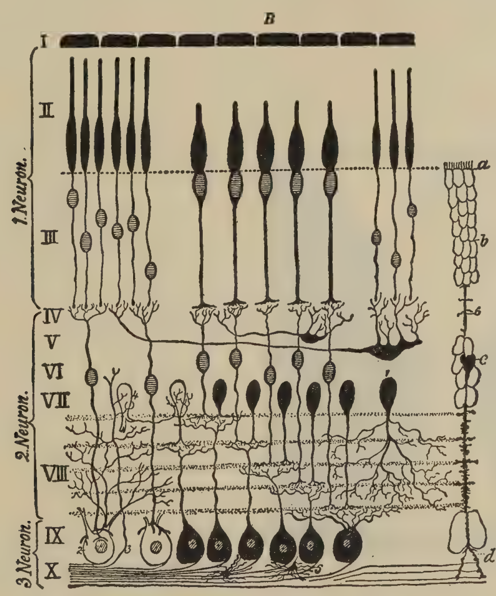
It would not be wise to carry the parallel of the camera and the human eye too far. The human eye is a sphere, it moves easily in its bony socket as paired muscles turn the eyeball right and left, up and down, and in many intermediate directions to suit the need of placing the retina in a straight-line relation to the rays of light coming from the object of interest. The angle of the direction of sight in the two eyes changes as we approach an object, and in the course of time the kinesthetic impulses from the muscles that angle the eyes become cues that tell of the distance of objects. The intensity and quality of the grays and colors of the object likewise change as we approach objects, and these intensities and qualities also become cues of distance. Thus, the experience of walking to objects or away from them becomes bound up with the visual experience and in the course of time provides the basis for the meaning of visual experience alone.

The intricacies of the eyes may so impress us that we may overlook its limitations. It is well protected by its bony socket; eyelids, tear glands, and tear ducts tend to keep a shining surface fit for the reception of light; and yet the eye is easily injured. The lens may adjust within such narrow limits that the image is focused in front of the retina or perhaps behind it, and the cornea may get out of shape, making it necessary to use artificial lenses that correct for short- or long-sightedness and for astigmatism. We are fortunate if we learn in time to protect the retina from glare or from the blue blazes of electric arcs and other harmful lights. It may be also that we have the misfortune to be among the 4 or 5 persons in 100 who are color-blind.

The Retina.—The retina is of spongelike consistency and under the microscope presents a complex structure with distinctive layers. The layers are due to alternating concentrations of nerve cells, of areas where nerve fibers of one set of cells meet those of another set, and of supporting tissues. Close to the inner surface lie pigment cells; as we look into the eye through the pupil, the pigment cells are presented as the dark screen on which the images are thrown. The pigment cells extend below the surface and mingle with the upper ends of the cones, which with the rods constitute the sensitized nerve elements of the retina. The rods and cones are the modified dendrites of nerve cells that lie just behind the surface. The axons from this outer layer of cells connect with the branching dendrites of a middle layer of cells; the axons of the middle layer connect with the dendrites of a third layer, whose axons join to make the nerve trunks of the optic nerve which leads to the midbrain.

The retina is translucent, but only the rods and cones seem to be significantly sensitive to light. The cones are sensitive to colors and to varying intensities of grays. The rods respond only to the grays. The retina covers most of the inner surface of the eyeball, but the same light image falling on different areas leads to different kinds of stimulation and of conscious experience. The differences seem to be

based on different degrees of concentration and different ratios of rods and cones. The areas of the retina farthest removed from the rear center of the retina are least sensitive. In these lateral areas there are a high percentage of rods and fewer cones. Directly behind the center of the lens there is a small area on the retina known as the *yellow spot.*



STRUCTURE OF THE RETINA.

I, inner surface; II, rods and cones; III, inner-layer neural cells; IV, synapses; V, association cells; VI, VII, middle-layer neural cells; VIII, synapses; IX, outer-layer neural cells; X, fibers making up optic nerve going to brain. (*From P. H. Mitchell, Textbook of General Physiology, after Howell.*)

The yellow spot is oval in shape and about 1/12 inch long, and in its center is a slight depression, the *fovea*, the most sensitive area of the retina. There are no rods in the yellow spot, and the cones dominate the adjacent areas. It is estimated that in the yellow spot there are approximately one million cones in an area less than 1/10 inch square.

Seeing Is More than Stimulating the Retina.—Images fall on the marginal areas when we see things "out of the corner of the eye." Such images are not well defined, not in

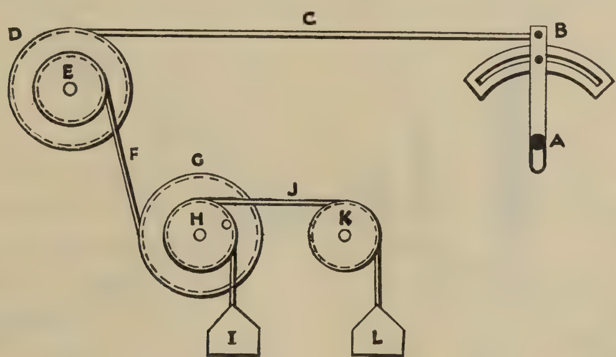
focus, particularly when our attention is upon something else at which we are looking directly and which is neatly focused upon the fovea. Why does the direction of our gaze change from the thing in the center of vision to things whose light image falls upon a marginal area? In other words, since the thing that has the center of the stage has such an advantage, why does it give it up to a marginal image? The answer is to be found in seeing the circumstance in its larger setting; the object that has the center of the stage is part of an experience that is more than visual in nature. The babe sees with little purpose, but even the babe sees purposively; the organism is set for bringing the brighter objects and the moving objects into the center of vision. As the life becomes purposeful, the whole business of seeing comes under the influence of the stream of life and the stream of conscious experience. Common experience verifies this; literally thousands of images of objects come within the range of vision but never get to the center of the stage visually because they are not suited to the stream of purposeful living that dominates the conscious life of the individual. What has bearing upon the situation at one minute has less bearing the next minute; what was in the margin of the visual pattern may soon be in the center of the retinal pattern and upstage in the conscious pattern. Needless to say, the visual may succeed the auditory in the center of the conscious pattern and the auditory follow other sensory influences as the stream of life takes new direction. The whole is an organized whole, with the parts in relation one to another as we make cause with the issues of life, as

FACES OR VASE?

What one sees changes with neural patterns of retina and brain. (*From L. I. Franz and K. Gordon, Psychology.*)

we establish new relations with our environment. Our experience is an organized whole whether in purposive activities such as breathing or in purposeful activities of solving problems.

The unity and relatedness and continuity of this larger drama are further revealed in many interesting visual phenomena which can be only mentioned here and left for the special study of the reader. After-images when viewed in experimental situations are novel, but they are operative in experience without our knowing it. Look at a light, close

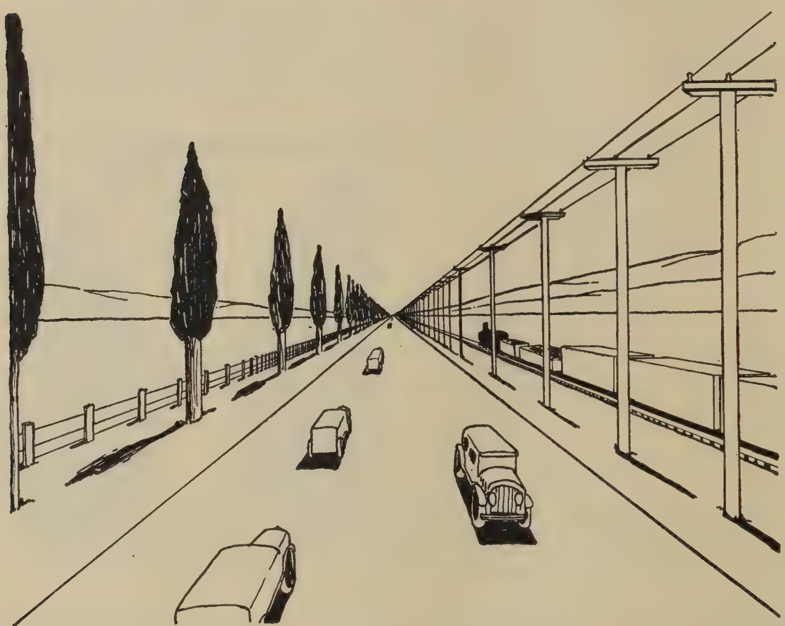


WHICH WAY DO THE WHEELS GO?

When *B* moves to the right, which way do the wheels turn? Does *I* go up when *L* goes down? When *F* goes up, does *J* go to the right? Does *H* go faster than *K*? (*From L. I. Franz and K. Gordon, Psychology.*)

the eyes, and the visual experience persists; the facts are operative in much the same way when the succession of frames of the motion picture are overlapped through after-images to make a continuous experience. So also in reading, the eye moves in a series of fixations along the line, but the after-images make the experience seem continuous. Our understanding of machinery involves interesting complexities of time and space relations. Illusions also point to relational aspects of experience; things are made crooked that are straight, made shorter or longer, made slimmer when they are fat and fatter when they are slim. The artist, the designer, the architect, and other creators of our practi-

cal and artistic environment deal with the illusory nature of vision. In color they likewise mix the environmental ingredients to meet the specification laid down in the nature of retinal nerves; if certain contrasts and harmonies are desired, the creator must deal with the psychology of complementary colors and the influence of intensities of grays which make an almost unbelievable range of color



The Artist Works with Illusions.
(*From L. I. Franz and K. Gordon, Psychology.*)

experience. The painter of a landscape, the designer of woman's apparel, or the more prosaic decorator giving a new coat of paint to an old house—each mixes his pigments and dyes in terms of the physics of light waves on the one hand and on the other in terms of the physiology of the action of light waves upon retinal nerves and of the psychology of color experience as it relates to seasonal styles. In the whole game of experience, man orders his environment according

to his nature if he is to live in peace and happiness with it. Through sensory experience there opens the possibility of wide ranges of esthetic satisfaction in line and form and color, in tone, in taste and smell, and in the creative artistries of the human hand; a lifetime of learning cannot exhaust these possibilities. Truly, it is what we make of the raw materials of the senses that makes life good or bad, prosaic or poetic, ordinary or beautiful.

Summary: Purposive and Purposeful Relations with Environment.—In this chapter we have ended much as we began, working toward a better perspective and a better understanding of the relations of the human organism and its environment. In general, our better perspective enables us to see that human nature is indeed adaptive but it is more than adaptive. It is not merely responsive, doing something or other because it is acted upon by the environment. This can be said even for lower orders of animals, and man far outstrips the best of these in his ability to transform his environment according to his own needs. The human organism reaches out in *purposive* ways to join with environment in caring for basic needs; it reaches out in *purposeful* ways to create a life of security and esthetic satisfaction.

Our purpose has been to gain a better comprehension of the organic basis of the dynamic aspects of human living. Our lives are indeed rooted deep in the activities of living tissues: (1) living cells reach into the inner environment for the satisfaction of their basic needs; (2) the organism reaches out to the outer environment for whatever may be essential for the maintenance of the steady state of this inner environment of blood stream and plasma. We do not live long if we do not take active measures to breathe air, secure food, shelter our bodies from excesses of cold and heat, and protect ourselves from the forces of nature and from other living beings. We are not long satisfied with mere protection and mere shelter and mere eating and

mere breathing. We organize the outer circumstances of our lives through social cooperation so that food, clothing, and shelter are available and protection of various sorts insures easy access to things required to satisfy other basic needs; then, in a life of controlled leisure and security, mankind unleashes his creative abilities and rededicates himself to the art of living rather than to the need of living.

It may be that at times we do blundering jobs in our effort to control our environment for purposes of security and esthetic living; strange as it may seem, it is possible that such blunders may be due to too little consideration for the basic needs of living tissues. After all is said and done, our lives are never widely separated from these basic needs. They impel us to action; we direct our intelligent efforts towards ends that may give us rewards in emotional satisfactions arising from orderly regulations of our inner lives. The arts, as we shall have occasion to note in Chap. XVII, are very practical in their origin; the art of living arises from activities that are basic to our existence.

This chapter has joined with those which have preceded it in laying the basis for our understanding of higher orders of behavior. Our purpose in these chapters has not been that the student should master details of physiological activities or of the sensory activities that are essential to intelligent relations with environment. It is perspective that is needed, perspective that comes with an acquaintance with the general problem of organic relations and principles. The framework of our study has been built about the following concepts:

1. We study life in action; we study its changing patterns of behavior.

2. Changes in the pattern take place through the processes of growth, maturation, and learning.

3. These processes are whole-to-part in their nature.

4. Our interpretations of development and behavior tend to center about the three factors of (*a*) inherited growth potentials, (*b*) interaction of organisms and environment,

and (*c*) interrelation of differentiated parts within the larger unity of the whole.

5. From simplicity to complexity is the rule, both in the ascending order of the species and in the development of the individual.

6. Patterns of behavior on many levels arise in the course of normal development and in intelligently meeting novel situations.

7. Paralleling the transition from simplicity to complexity, organisms widen the ranges of environmental situations to which they make adaptations; they become more aware of what they are about. Purposive existence tends to become purposeful living; there is more direction on the conscious level.

8. Life purposes of a higher order are rooted in satisfying the basic needs of living tissues.

It is sometimes said that in certain situations we cannot see the forest because of the trees, that is, that the larger perspective is lost because of meticulous attention to the details. Forests, however, are made of trees, and an understanding of basic human behavior comes from considering first one aspect and then another of the inner organization and control that serve the life needs of body tissues. We have looked to the details for the purpose of an adequate comprehension of the larger fact that the living organism is more than merely responsive, that adaptation means action on the part of the organism which presents a united front to the business of living. With such perspective, we cannot make the mistake of conceiving human behavior too simply. With such perspective, we must proceed with our study, knowing that we must interpret the particulars of behavior in the light of the onmoving stream of purposive and purposeful living in which the particulars play their part.

In the next chapter we shall continue with much the same theme as we consider the more highly organized but basic patterns of our emotional behavior.

SUGGESTIONS FOR NOTEBOOK AND BULLETIN BOARD

It is suggested that you check the organization of materials of your notebook with the list of concepts given in the summary to see how well your notebook represents what we have studied.

SUGGESTED READING

The suggested reading in line with the purpose of this chapter tends to be technical, but even a hurried survey of some of these sources will be helpful in gaining insight into the trend of biological science and psychology.

1. Childs, Herrick, Coghill, and other biologists in the United States have done much work that is based on the organismic point of view. If time is limited, the reader is advised to use the tables of contents and indexes of these references and select topics in line with his interest. For convenience, titles of volumes previously noted are given here.

Childs, C. M., *Physiological Foundations of Human Behavior.*
Coghill, G. E., *Anatomy and the Problems of Behavior.*
Herrick, C. J., *Neurological Foundations of Human Behavior.*
Cannon, W. B., and A. R. Rosenblueth, *Autonomic Neuro-effector Systems.*

2. Haldane, Hill, and Adrian are English scientists. Haldane's *Organism and Environment* presents a series of lectures delivered at Yale University. Hill's *Adventures in Biophysics* and Adrian's *Mechanism of the Nervous System* present lectures delivered at the University of Pennsylvania. Together the works of these authors point to the international interest in the organismic approach to behavior.

Chapter Six

Emotional Behavior

Our language is fairly loaded with terms that stand for various kinds of emotional behavior. Our way of speaking of animals shows that we commonly attribute emotional qualities to much of their behavior; we say that our dog barks with joy or hangs his head in shame, that he is afraid of the neighbor's dog, that he hates the cat and gets angry and savage whenever he sees her about. We recognize in our friends permanent emotional dispositions; one friend is generally happy, another is proud, and another is timid. Experience cannot be adequately described unless we speak of the emotional qualities that are part of it. Strong emotions and weak emotions, pleasant emotions and unpleasant emotions, defensive patterns of behavior with their characteristic emotional qualities of fear and apprehension, offensive patterns of behavior with their emotional qualities of anger, pride, envy, hatred, and the like—emotional behavior of some kind and to some degree is with us always.

The emotional quality of behavior may help or hinder in making adjustments to life. It is understood that enthusiasm makes learning easy, but one may be merely enthusiastic and learn little. Courage is an admirable quality, if it is not too pugnacious. Fear handicaps many lives, but other individuals are so fearless that they are foolhardy. The emotional aspect of life is certainly a matter worthy of

understanding, but on first consideration one may well be impressed with its complexity. It must be admitted at the outset that there are many questions concerning emotional behavior to which no answers have been found, but this is of course but an added stimulus for developing such understanding as is possible.

Approaches to the Problem of Emotional Behavior.—Where can one find a point of beginning for the study of emotional behavior? One approach may be suggested by the fact that the common needs of life may easily involve the emotional aspects of our natures. Hunger and thirst and cold and heat and pain and fatigue color our lives and characterize our behavior in a manner that is emotional. Grapefruit gives zest to breakfast, coffee helps us to meet the tasks of the morning with good cheer, but what a different picture we present in the late afternoon when dinner seems hours away! Extremes of heat or cold may make one miserable; they may drag one from the heights of purpose and enthusiasm into the depths of discouragement. A happy occasion may be ruined by the pain and discomfort of as little as a tight shoe.

This intimate relation of emotions to the essential behavior patterns raises the question of what takes place physiologically in the course of emotional behavior. The sinking feeling in the pit of the stomach indicates a relation between an emotional experience and visceral activity of some kind or other. People blush with shame or embarrassment. Fear or rage is accompanied by increased activity of the heart and the sudden acquiring of ability to do things that would otherwise be impossible.

These relations between emotions and the basic and essential patterns of behavior may well lead one to ask if there are inherited patterns that are emotional in nature. Such a query would lead to the examination of the behavior of newborn babes to determine the character of emotional life at that period. Many patterns of behavior are definitely formed at birth, and many more are in the process of forma-

tion. Are there any basic emotional patterns present at birth? This query leads naturally to another, for it is very apparent that the whole character of behavior changes rapidly after birth; we are thus faced with the interesting and important problem of the development of emotional behavior and the relation of this development to developing intelligence. In other words, there is the question of how children learn to control their emotions. Following the same line of inquiry we may well ask how we develop the higher emotions or sentiments which are so prized because of their social worth. In this connection it should be interesting to find the relation between the emotional and the artistic, for such a relation is very generally admitted.

Such questions as these do not necessarily simplify the complex problem of emotional behavior, but they do at least suggest definite modes of approach based upon our everyday experience. In following any one of these approaches it may be expected that other lines of inquiry will become involved. When we study the emotional aspect of human behavior, we in a sense select and follow a certain approach to the study of the whole of behavior. In other words one should not expect to find emotions as something apart from the rest of human life.

Emotional Development in the First Year of Life.—What is the nature of the emotional life of the newborn babe, and what are the changes that take place during the first year of life? There are marked changes in the character of behavior during this period, and these changes tell a story of developing emotional life as well as of physical and intellectual growth. During the first few weeks, babies generally sleep and doze more than 20 hours of the 24. They are passive while the physiological adjustments to their new environment are being made. During the other 4 hours of the 24, in which they are fully awake, their behavior is for the most part negative, protesting, and defensive in character.

Let us go to the Psychological Clinic in Vienna, observe with Dr. Charlotte Bühler[1] and her associates how babies respond to the world into which they are born, and note the changes that come with the passing months of the first year of life. In these records, we find data on the emotional aspects of the baby's nature, and we shall also find new understanding of the nature of maturation and the beginnings of learning and of intelligent and conscious behavior.

An Early Life of Protest.—First, let us look at the records of behavior of a few of these babies, to see something of the nature of the unlearned behavior of the babe, some of which is decidedly emotional in character. The babe sleeps and dozes most of the time in the first few weeks following birth, but when he is awake his life seems to be dominated by protesting and protective reactions. Here is a boy, No. 50, at the age of one month, who "trembles when the window is noisily shut. He moves his arms and legs about, clenches his fists, wrinkles his forehead, moves his fists toward his face and, after he has let out a low cry of fright, he begins to cry." Another boy, No. 12, two months old, "lies quietly gazing in his bed. An automobile goes by bumping in the street. He shrinks back and lets out a sound of fright, opens his eyes wide and throws his head back, stretches his arms sidewards, spreads his fingers, opens his mouth and utters a cry of displeasure." A little girl of two months, No. 11, "slumbers, becomes restless in her bed from the sound of flowing water in her bathtub. She opens her eyes wide and then her mouth, turns her head, lifts her forehead a little, exhibits typical expressions of surprise, and begins to whimper."

Let us add to the preceding extracts the following abbreviated record of a half hour of the life of a little girl of four months of age, No. 21, who is tired after active play. "She is lying in her bed again, sucking her thumb and

[1] Bühler, Charlotte, *The First Year of Life*, The John Day Company, Inc., 1930.

observing her fingers." Five minutes later she yawns, and begins to whimper, and keeps this up for ten minutes, stops, looks around, whimpers again, and then for two minutes busies herself with playing with her hands, seizing the railings of the bed, pulling her ears, and covering her face with her hands." The record for the next 8 minutes is as follows: "Lifts her body and head; babbling, she throws off her cover." Then during the next minute she notices the nurse and starts to murmur; in another minute the murmurs have turned to screams; she "covers her eyes with her little hands, continues to scream, kicks with her little legs." In 5 minutes she "quits, turns her head sideways, closes her eyes, opens them again, turns her head to the other side, closes her eyes again, and tumbles down tired." For the next 5 minutes she is quiet, now and then opening her eyes, then "sleeps heavily and sound."[1]

A great amount of the waking life of the very young babe is, as shown in the clinical records quoted above, spent in screaming and crying and in protestations of one kind or another. He of course does not understand that there is no good reason for him to be afraid of the ordinary noises and the ordinary handling and bathing that is a part of a well-regulated baby's life in our modern civilization. On the other hand, we who are accustomed to these routines of civilization sometimes fail to understand or remember that infants for many, many generations had a quite different set of life circumstances in which to do their living. It is to this old order of circumstances that the behavior pattern of the newborn is adapted. In those prehistoric days, it was the baby who screamed and cried who brought a mother to his rescue, to whom food was given, and for whom protection from cold winds was provided. Fear and protest against noises, sights, and contacts that might mean danger were the baby's means of self-preservation, and even today they remain his best means of acquainting us with his needs. Seen in the light of other days of long ago, it is not

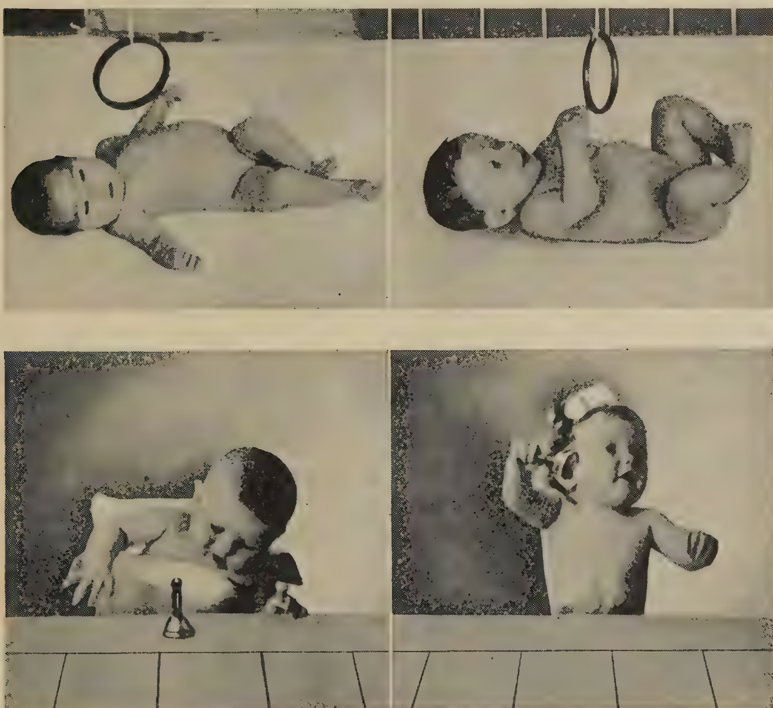
[1] *Ibid.*, pp. 41 *ff.*

surprising that the early behavior patterns of the infant are negative and protesting in character.

The Change to Spontaneous and Pleasurable Activities.—Remarkable changes take place during the first year, and at the end of 12 months a decidedly different emotional being has developed. The 4 hours of negative protesting reactions found during the first month have been reduced to 1 hour by the end of the year; this change is of course evidence of developing emotional control. Positive reactions have increased from 1 hour in the first month to 2 hours at the end of the year. The most significant change, however, is in the increase in spontaneous activity. Bühler assigns 24 minutes to such activity during the first month and approximately 2 hours during the period covering the second, third, and fourth months; then come a sharp increase to 5½ hours during the fifth to eighth months and still another sharp increase in the last 4 months of the year, when the babe is devoting 8 hours to these playful activities. The term *playful* correctly describes this behavior and signifies the emotional character of the experience. These spontaneous activities are related to the natural processes of maturation. They are of prime significance in the development of the basic behavior patterns such as talking, walking, and general body control, and they are of equal significance in the development of patterns of learned behavior on higher levels of intelligence. These most significant changes in the activities of the child are pleasurable, and this positive emotional disposition toward life keeps pace with the development of the physical and mental abilities.

Summarized from the standpoint of emotional behavior the changes in the first year of life are as follows: (1) approximately an 8-hour reduction in the emotionally neutral life of sleeping and dozing; (2) an 8-hour increase in the emotionally pleasurable business of spontaneous activity through which new patterns of behavior are developed; (3) a decrease from 4 hours to 1 hour in protesting negative

behavior; (4) an increase from 1 to 2 hours in positive responses. Thus, the development of the positive and pleasurable elements in emotional life is found in the closest alliance with the developing physical and intellectual abilities, which are so obvious during this period. Through



THE BEGINNING OF PLAYFUL BEHAVIOR.
Responses to dangling ring at 8 weeks and 20 weeks. Responses to bell at 16 weeks and 52 weeks. (*From A. Gesell and H. Thompson, Infant Behavior.*)

this balanced development the child is put into more effective relation with the life about him.

Are There Basic Emotional Patterns?—What emotional patterns are to be found early in life before learning has had an opportunity to become effective? Is it possible to identify definite emotional patterns in the newborn babe, or is the emotional behavior of early life so undifferentiated that it

can be classified only as positive and negative? Watson[1] and his fellow workers concluded that newborn babes show three types of emotional response, namely, fear, rage, and love. At the time of the report of his observations and experiments, this limited classification seemed very restricted because it was then customary to think of emotions as being a part of instinctive behavior and because since there were supposedly many instinctive behaviors there was likewise a tendency to think of many emotions that could be identified along with the instinctive behaviors. Since that time the whole matter of instinctive behavior has been under question, and further investigations along the line of Watson's experiments have tended to put in question even the three basic emotions that he thought he could identify. Let us look further into the experimentation of Watson and his critics.

Two of the three emotional responses that Watson identified, namely, fear and rage, he has described in terms that suggest considerable similarity between them. Crying and screaming are described as part of both the fear and rage responses, as are also random activity of arms and legs and catching and holding the breath. The subsequent work of Sherman and others[2] in checking the experiments of Watson makes it appear doubtful that differences in these two types of responses can be recognized. The activities of the infant in response to outside stimuli are unstable, and there is little basis for assuming that there is a pattern of behavior that definitely relates the stimulus and the response in the experience into a well-organized whole. Sherman found that neither trained nor untrained observers could consistently identify different responses as being expressions of a particular emotion.

[1] Watson, J. B., *Psychology from the Standpoint of a Behaviorist*, J. B. Lippincott Company, 1919.

[2] Sherman, M., and I. C. Sherman, "Sensory-motor Responses in Infants," *Journal of Comparative Psychology*, Vol. 5, pp. 53–68, 1925.

Sherman, M., "The Differentiation of Emotional Responses in Infants," *Journal of Comparative Psychology*, Vol. 7, pp. 265–284, 1927.

It seems probable that Watson and his coworkers read into the observed responses much of their own knowledge of the stimulus situations which set off the emotional activity. The situations that Watson assigned as arousing the fear response were loud sounds, the sudden dropping of the infant, or suddenly pushing or jarring him. The rage response was induced by holding and restricting the movements of the infant's head or arms. Sherman, in checking Watson's work, separated the stimulus phase in the experiments from the response. For example, the stimulus would be given to the infant out of sight of the observer; then the screen would be removed for the observer to judge whether the response was one of fear or rage. The same purpose was served by cutting and reorganizing parts of motion-picture films made of the experiment. One group of observers was shown the whole experiment in the regular order of the stimulus (loud sound or dropping or holding of arms) followed by the response. For other groups of observers the film was cut and the parts reorganized in various ways so that the responses did not follow the stimuli as in the original film. Comparisons of the interpretations of these groups established the fact that knowledge of the stimulus situation was a potent factor in naming the emotional response. These experiments are in general accord with others which go to show that the behavior of the newborn babe is so general and unorganized in its nature that it is difficult to distinguish patterns to which there can be assigned definite emotional character.

Watson's use of the term *love* to denote the positive emotional response of the newborn babe is confusing, for here a wide variety of stimulus situations have been interpreted as leading to the same responses. The stimuli described are stroking, patting, gently rocking, or rolling the infant on its stomach across the knees. The responses described are gurgling, cooing, smiling if this behavior pattern has had time to develop, or, if the babe has been crying, the cessation of the crying. It is difficult to see how

the term *love* can apply to a babe's reaction to being rolled on its stomach, a practice that is usually associated with relief of the babe from gas pains in the intestinal tract. Again the experimenter seems to have read too much into the infant's behavior, and we tend in our interpretations of these early emotional responses to look upon them as very general in their nature.

Our preliminary search for information on emotional patterns of early life has brought to our attention two facts that are suggestive in our further study. (1) The evidence verifies our common observation that emotional behavior is related intimately to the activities that are basic to life; self-preservation, food getting, body comfort, and sex are the purposes served by the activities in which we find strong emotional elements. (2) Emotional life starts in a very undifferentiated state, and its development is intimately related to physical and intellectual development. The close relation of the emotional to the essentials of life becomes very apparent as we consider the physiological basis of emotional behavior.

The Physiological Basis of Emotional Behavior.—In general there are three types of physiological structures that are especially involved in emotional behavior, and these are the structures that are involved in meeting basic tissue needs. (1) There are certain endocrine glands and visceral organs whose secretions change the character of the blood stream and thus influence behavior. (2) There is the autonomic nervous system. (3) There are the lower and midbrain areas, particularly the thalamus which is an important switchboard of the midbrain. Only one other important area is concerned with the control of human behavior, and that is the higher brain centers which are particularly concerned with learning. Thus the control of emotional life is found in centers that control basic behavior, in contrast to control of learned adaptations to the environment which is found in the cerebrum. Human life cannot get far without the collaboration of these controls, but we will

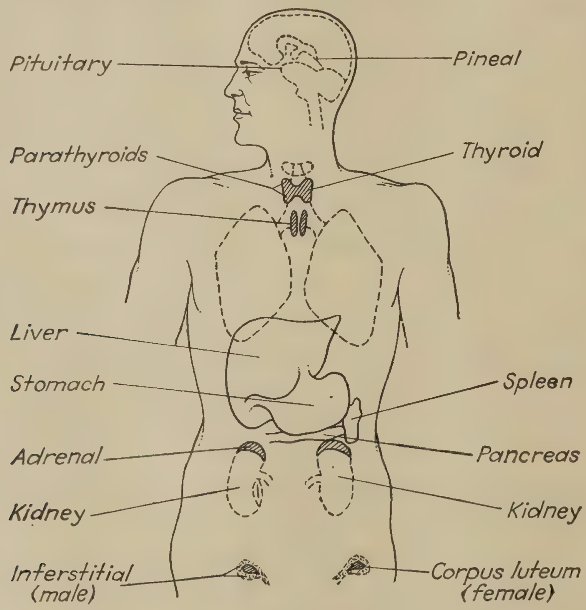
find the explanation of the character of emotional experience in the conflict or accord of these two systems, one of which directs the inner life activities, the other being the avenues through which we take intelligent account of the varied situations that confront us from without.

Hormones Are the Messengers of the Blood Stream.—In Chap. V we found adrenin and other agents playing a significant part in the interaction of nerve and muscles and glands. Adrenin is one of many hormones. These are chemical products of the activity of various glands and tissues. They do not enter into chemical action but are essential to many chemical changes in the blood stream and in cellular activity. They do act directly as stimuli to set into activity many organs, and they change the character of the activity of many tissues. Hormones are generally found in the secretions of endocrine or ductless glands. They enter the blood stream directly from the tissues in which they are secreted. Once in the blood stream they are brought to all parts of the body through the circulation of the blood and thus influence the activity of organs and tissues to which the blood is carried.

More than 20 distinct hormones have been chemically isolated, and it remains for future scientific effort to determine how many more there may be. At least 10 distinct hormones are secreted by the pituitary body alone, each with a distinct chemical composition and with a more or less definite influence upon certain other glands and tissues of the body. Each year finds the results of investigations adding new knowledge concerning these messengers of the blood. With an understanding of the information available at present, it is apparent that they exert a tremendous influence upon development, health, and the balanced control of behavior. This picture might easily be exaggerated, and in the interest of caution the following survey is based upon the reports of the biochemists,[1] in order that only definitely determined hormones may be discussed.

[1] Harrow, B., and C. P. Sherwin, *The Chemistry of Hormones*, Williams & Wilkins Company, 1934.

The Location of the Endocrine Glands.—The accompanying diagram shows roughly the location of the endocrine glands and other tissues that are known to secrete hormones. They seem to be indiscriminately distributed throughout the head and the trunk, sometimes with seemingly little relation to their function. Since they do their work in and through the blood stream, the matter of their



General Location of Endocrine Glands.
(*From W. C. Varnum, Psychology in Everyday Life.*)

origin is of secondary importance. Variation in the endocrines is much more marked than in other organs of the body. The size of the different glands varies greatly, and the same gland varies in individuals both in size and in activity.[1] This variation in individuals undoubtedly has much to do with differences in temperament and personality.

The pituitary, one of the most important of the endocrine glands, is a small capsule located at the base of the brain.

[1] Freeman, G. L., *Introduction to Physiological Psychology*, p. 554, Ronald Press Company, 1934.

In this gland the anterior, posterior, and intermediary portions function each as a unit. The pineal gland is also located in the brain, occupying a very small space in the lower brain. In the neck, on two sides and bridging the trachea are found the thyroids, and within these are the small glands known as the parathyroids. Within the chest cavity, lying next to the trachea and directly behind the upper part of the breastbone, is the thymus. In the abdominal cavity are found the important suprarenal glands, located, as the name implies, upon the upper ends of the kidneys. Two distinct parts are incorporated in the suprarenals, for in both structure and function the cortex or outer portion and the inner medullary portion are different. From the sex glands come the hormones that play an important part in the development of secondary sex characteristics. Insulin, the hormone secreted in the pancreas, is well known for its role in the cure of diabetes. Another hormone, secreted in the upper area of the small intestine, acts to stimulate the pancreas to the secretion of insulin and also influences the activity of the liver. Although the liver is not an endocrine gland, it plays an important part in emotional behavior.

Function of the Hormones.—Chapter V gave a picture of the way the body maintains its inner environment of blood stream and plasma as an essential to life. In this inner environment there are maintained a balance between oxygen and carbon dioxide and a balance between the lactic acid by-product of muscular activity and ammonia from the liver. There are also maintained a tenuous balance of calcium content and a balanced control of body temperature. In addition to the balanced activities of the inner environment, the hormones are influential in other essentials of life. Body posture and the ability to stand erect are maintained through a constant stream of excitation of the musculature of the body. These excitations arise directly from the hormones in the blood stream and from a continuous flow of nervous energy from nerve centers, particularly

from the semicircular canals and the thalamus. The tonus of muscles for body posture offsets the constant pull of gravity and resists the continuous pressure of the air in which we live. There are hormones that stimulate and hormones that retard activity, streams of nerve impulses that accelerate and counter streams that retard activity. Certain tissues are differentiated to respond to certain hormones and other tissues to other hormones. Hormones are essential factors in the drama of balanced metabolism, balanced muscle tonus, and balanced development of different organs and tissues. They are summoned to meet emergencies; they are present to maintain health and the conditions that are essential to developing physical and mental capacities. A brief survey of the hormones concerned with growth and metabolism should lead to an appreciation of how essential to life are these messengers of the blood stream.

Hormones That Influence Growth and Metabolism.—The sum of all the processes that supply energy and new protoplasm to the body we call *metabolism*. Growth depends upon metabolism, and so we may well consider the influence of the hormones on both. Several glands play a definite role in the growth and development of the organism and in its general metabolism. The thymus, though it is more definitely related to sex development, also has a function in the all-round development of the body. The hormone of the thyroid gland, thyroxin, is related to general development and general body metabolism. A deficiency of thyroxin leads to obesity and makes the regeneration of tissues slow, probably because of its relation to the processes of elimination of waste products from the blood. Excess of thyroxin leads to the development of goiter which is accompanied by restlessness, irritability, and the tendency to become easily depressed. Opposite behavior tendencies of dullness and sluggishness arise from deficiencies of thyroxin, the extreme manifestations of this deficiency appearing in cretinism in which malformed body structure accompanies idiocy. Remarkable effects are produced in cretin cases by the

introduction of thyroid extract into the blood stream at regular intervals. The parathyroids seem to be related to the control of the calcium content of the blood stream. Deficiency in the hormone of the parathyroids leads to extremes of excitability and mental depression.

The secretions of the anterior lobe of the pituitary contain several hormones that are related to growth and metabolism. One of these hormones acts through its stimulation of the thyroid, and another, phyone, acts directly upon the tissues of the body. From the anterior pituitary comes a hormone that influences the metabolism of fats and that also has a minor influence on sex glands. From the same source comes a carbohydrate hormone that influences the metabolism of sugars and starches.

Depressine is one of the hormones secreted in the posterior lobe of the pituitary and is related in function to the elimination of urea. The hormone cortin, secreted in the cortex of the suprarenal glands, likewise influences the activity of the kidneys and is also concerned with the metabolism of carbohydrates. A deficiency in this hormone leads to general languor and debility. Attention has already been called to the hormone of the pancreas, insulin, and to the hormone secretin which stimulates the pancreas. Secretin, or perhaps a second hormone of the same origin, also influences the activity of the liver and increases the flow of bile.[1]

Hormones Related to Sex Development and Function.—There is a complicated interaction of the hormones of various endocrines which influence the development and functioning of the sex glands. The development of the secondary sex characters that appear at puberty is dependent upon the activity of many endocrine glands whose development and balanced activity is responsible for the development of the sex glands.

[1] The effect of vitamins upon human behavior is unquestioned, but it is not so dramatically evident as that of hormones; one wonders concerning the physiological relation between these two agents of well-being.

The thymus plays an interesting role as an inhibitor of sex development. It is of good size in childhood and continues to enlarge until puberty, after which it atrophies. Slow sex development at puberty may be caused by the continued dominance of the thymus, whereas the early development and early atrophying of the thymus may be a contributing cause of the precocious, self-willed behavior of some adolescents. Thyroxin is another hormone that influences sex development and function. Mention has already been made of the minor sex influence of the fat-metabolism hormone of the anterior pituitary. From the anterior pituitary comes another hormone concerned definitely with sex development, and from the intermediary region of the pituitary there is generated a hormone, intermedin, that has a similar function. From the pineal gland comes a hormone that, like the hormone of the thymus, inhibits the development of sex organs.

Emergency Functions of Hormones.—A posterior pituitary hormone, pitressin, acts in all emergencies to contract the smooth muscles of the arteries, thus increasing the blood pressure. Adrenin from the medullary core of the suprarenals plays a role in emergencies similar to that of pitressin; it constricts the walls of the arteries and slows the rate of the heartbeat but stimulates its strength. The effect of these emergency measures is to increase the supply of blood going to the skeletal muscles, inhibit the action of the smooth muscles of the viscera, and through direct action upon nerves and muscles raise their sensitivity. Another supplementary emergency measure comes from the action of the liver which pours into the blood stream the stored glycogen, making available to the muscles an abundance of energy-giving material. Adrenin also has the property of hastening the clotting of blood. Hormones play an important role in the emergency of childbirth.

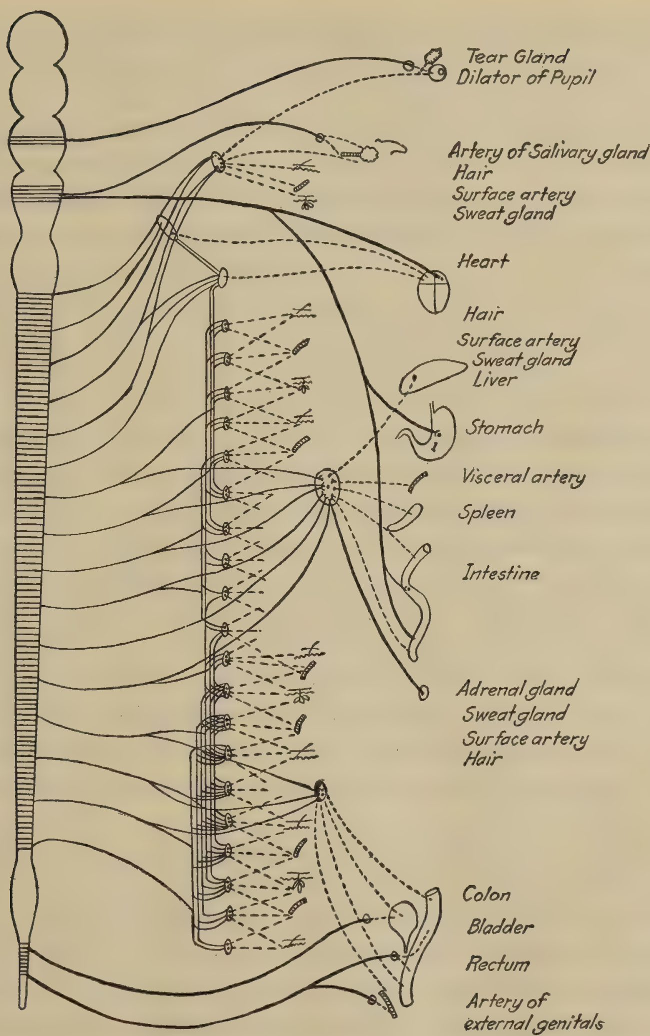
Hormones and Emotional Behavior.—A survey of the activity of the endocrine glands leaves no doubt of their influence upon life. Health and normal development depend

upon their balanced functions. Through them remarkable provisions are made for a wide range of emergency situations. They are at the very roots of our existence. They play an important part in determining what we do and how we do it, whether we live joyful or repressed lives, whether we meet emergencies with courage or with fear.

It should be remembered, however, that hormones must be secreted by glands and though glands may be stimulated by the hormones of other glands, they nevertheless receive the major part of their excitation from the autonomic nervous system. Indirectly, and at times directly, glandular activity is connected with the central nervous system. It should be apparent that the whole range of messengers of the organism may be involved in emotional behavior. This messenger service that controls and coordinates behaviors includes the system of hormones, the nerve impulses from the autonomic system, nerve impulses from the lower brain and midbrain, and likewise nerve impulses from the cortex of the cerebrum. The primitive cave man when meeting a bear behaved in a manner that involved this whole range of activity. If he ran away or stayed to fight, it was a matter that involved more than endocrines and autonomic activity; success in either flight or fight depended upon a highly coordinated and facilitated activity that can be accounted for only through the neural patterns from the lower brain and midbrain. Then, too, fighting or fleeing involved to some degree, however small, the choice of where to flee or how to fight, the selection perhaps of an adequately tall tree, or the choice of ground where stones might be handy for the battle. So with other beings and other occasions. Most of emotional behavior has a quota of intelligent behavior in it, and most of intelligent behavior has in it a quota of the emotional. All activity is based on the continuance of the basic functions which are controlled by the autonomic division of the nervous system. As we shall see, the autonomic system plays its part in emotional behavior.

The Autonomic System and Emotional Behavior.—The autonomic system centers in the double chain of ganglia that lie in front of the spinal column and in certain nerve plexuses in the abdomen. The system functions as though it were divided into two parts, the two ends functioning much alike and the great midportion being different in function from the two ends. The whole system is concerned with the stimulation of glands and smooth muscles of the viscera and the circulatory system. It also has important connections with the central nervous system. The larger midportion, lying in front of the spinal column and extending through the region of the chest and the upper abdominal cavity, is called the *sympathetic system.* It functions to accelerate the activity of glands and smooth muscles with which it is connected. The two end portions, one in the region of the neck and the other in the pelvic region, are inhibitory to many of the organs and glands that the midportion accelerates. Since many glands and smooth-muscle organs are supplied with nerves from both the end portions and midportions of the autonomic system, their activity is a result either of balanced stimulation from the two regions or of a dominance of one part over the other. The midportion, or the sympathetic system, dominates in situations of emergency, causing a stronger heartbeat, increasing the rate of breathing, releasing glycogen from the liver into the blood stream, and at the same time inhibiting the activity of the digestive tract. The two end portions are in control of the functions of the digestive tract; when they are allowed to dominate the activity, the heart action is slowed, the regular peristaltic activity of the stomach and intestines is stimulated, and saliva and gastric juices are secreted. The emotional states accompanying behavior controlled by these end regions are rightly called *vegetative*, in contrast to the emergency character of fear, anger, and rage, when the sympathetic system is dominant.

Conscious Emotional Experience.—We have thus far been concerned, for the most part at least, with emotional



Connections of Autonomic Nervous System.

The spinal cord is represented at the left, the ganglia of the autonomic system in the center, and various glands and organs at the right. (*From P. H. Mitchell, Textbook of General Physiology, after Cannon.*)

behavior, which might or might not involve conscious emotional experience. The activity of the viscera and hormones, however significant they may be to emotional behavior patterns, cannot account for our conscious emotional experience. To account for conscious experience of any kind we must turn to the activities of the brain. There is an interesting history of theory and experimentation on the emotions[1] that is a record of the attempts to discover the part played by different areas of the brain and by the autonomic system through which the central nervous system may influence the viscera. Let us review briefly the high points in this historical development. Many years ago the prevailing explanation of conscious emotional experience was that it was due to a sort of brain storm which was stirred up by some situation presented. The brain having become thus stirred up, nerve excitations spread to all parts of the body, exciting the visceral areas and increasing the activity of the heart. According to this theory the conscious emotional experience arises from the activity of the brain, particularly the activity of the cerebrum which was and is considered the area most concerned with conscious experience. The visceral activity, according to the old point of view, was a secondary factor in the experience, a rebound of the brain storm.

The brain-storm theory was succeeded by another which made the rebound from the visceral activity the central factor in the emotional experience. This theory is commonly referred to as the James-Lange theory, it being thus identified with the two psychologists who put forth, almost simultaneously, quite similar interpretations. In contrast to conceiving that the emotional experience initiates in the brain and making the visceral activity secondary, the James-Lange theory makes the emotional experience the result of the visceral disturbances. According to the interpretation of the two psychologists, the brain is recognized as the ultimate source of conscious experience, but the cerebral

[1] For more details of this history see Freeman, *op. cit.*, pp. 130 *ff.*

activity is considered to be aroused by the visceral activity. A person does not run because he is afraid, but he is afraid because he runs. The sequence according to this explanation is that the man sees the bear, basic patterns of flight or fight are stimulated, these involve and arouse the visceral activity, and this activity sending sensory impulses to the brain stirs up the activity which accounts for the emotional experience on the conscious level.

The James-Lange theory was the center of much controversy, for it seemed that it was thoroughly in keeping with many human experiences but much out of line with many others. The theory was put in question by the experimental physiologists, first by Sherrington and later by Cannon and his coworkers, who revealed the functions of the various parts of the brain and sympathetic system. The experimentation that undermined the James-Lange theory was one in which the nerves leading from the viscera to the brain were severed. These were the sensory nerve trunks necessary for carrying to the brain the excitations that would lead to the emotional experience as it was conceived by James and Lange. The severing of these sensory nerves would have no effect upon the initiating of the basic emotional behavior that would lead to fighting or fleeing, but it would cut off the rebound arising from the visceral activity. Since both the behavior and the evidences of conscious experience remained much as they were before the sensory nerve trunks were severed, it was necessary to look elsewhere for the initiation of the emotional experience. Further experimentation showed that the viscera are relatively insensitive; they do not report to higher nerve areas much of their activity. This fact is shown when adrenin is introduced experimentally into the blood stream, for though it will stir up emotional behavior it does not make any significant change in the conscious emotional experience of the subjects.

From these experiments it became apparent that the experimenter would have to start with the stimuli from the

original situation as the cause of the emotion, rather than with the rebound stimuli from the viscera. The arousal of the brain activity comes from the original stimulation of the central nervous system. Most of the situations that stir us to fear and rage are presented to us through the eyes and ears, and the nerves from these sense organs lead to the lower brain areas, particularly the thalamus, from which the impulses are relayed two ways, upward to the brain centers of the cerebrum and downward by old established pathways to the viscera and musculature of the body which collaborate in patterns of flight and fight.

Other experimental data located the thalamus as a center definitely involved in emotional experience of a conscious nature. Future experimentation will undoubtedly result in a more precise picture of the part played by this center, but the data now available indicate that the thalamus is to be given foremost consideration in explaining emotional experience on the conscious level. This fact is thoroughly consistent with the part the thalamus, as well as the other lower brain centers, plays in the organization of the basic emotional behavior patterns. When the thalamus is injured accidentally in man or when it is removed experimentally in lower animals, the result is that both the patterns of behavior and the emotional experience on the conscious level are definitely affected.

The Collaboration of Midbrain and Cerebrum in Emotional Experience.—Observation of everyday emergency experience indicates the necessity of considering the neural patterns of the brain to explain emotional experience as we find it before us in everyday life. For example, take the experience of two twelve-year-old boys who were crossing a marshy hayfield one Saturday morning. They rode the length of the field on the hayrake while the hired man regaled them with exaggerated tales of blue-racer snakes. He said they were so thick in that field that they wound themselves about the horses' legs, tangled themselves into the spokes of the high wheels of the rake, and were rolled

into the rake with the hay. The boys laughed but listened, until they reached the end of the field where they were to leave the hayrake and continue to adventures in the woods beyond. The first boy jumped from the rake, back over the curved tines—then things began to happen to him suddenly and swiftly. When he "came to" a fraction of a minute later, he was perched on top of a rail fence 30 yards away. Jumping from the rake he had landed on a coiled blue racer, and emergency behavior had swiftly followed. But not until he surveyed the situation from the safety of the fence had the force of conscious emotional experience come upon him. In fact, he remembered little or nothing of jumping from the rake, of hitting the snake, and of how he had got to the fence. His companion assured him that he had landed on the snake and that he had done a marvelous job of getting to that fence. The question is: What centers control such neatly organized emergency patterns, and what brain areas are involved in the conscious emotional experience?

It is generally accepted that the cortical centers of the cerebrum act for purposes of general direction, whereas the midbrain, cerebellum, and medulla coordinate the details of the general plan. These latter are sometimes known as the *old-brain*, in contrast to the cerebrum which is designated as the *new-brain*. This designation of parts of the brain is in accord with many facts that have been determined experimentally, all contributing to the understanding that the cortex is an area that is superimposed upon the older midbrain and lower brain areas. The thalamus is an important area of the midbrain, containing centers of coordination of motor function with the sensory impulses from the eye and ear, and it plays an important part in maintaining muscular tonus. It is a relay center for incoming sensory impression, a sort of switchboard distributing and coordinating impulses from all parts of the body, and it is an important coordinating center for outgoing impulses that will ultimately reach the visceral organs. Thus the

thalamus may be seen as an important area of the old-brain, serving on a lower level somewhat the same functions that the cortex does on a higher level.

A person is conscious when his behavior is complex. It is the increased complexity of the cortex of the cerebrum that makes possible man's higher conscious levels of experience. It is to be expected that the activity of such a center as the thalamus might result in a quality of conscious experience fitting the complexity of neural pattern in it. Emotional experience probably involves both lower and higher brain centers, the lower centers being dominant. The boy jumped on the snake and quickly and effectively covered the distance to the fence. Such patterns of behavior are not products of the cortex; they are ready formed, and action follows quickly on the heels of appropriate stimulus. Note, however, that the boy took the shortest route to the nearest fence. The fence was a good objective under the circumstances, a degree of generalship having thus been shown that can be ascribed in part at least to cortical activity. But this boy knew that blue racers are not poisonous, and he knew that they will run from you if you run after them; so why did he not order his behavior accordingly, for he needed but to step off the snake and it surely would have run away? The best explanation of his behavior lies in the fact that the old-brain was in command of the situation. Human beings do not need to think before they act in emergency, but intelligent action soon joins forces with the well-established emergency patterns. With the set of mind that came from the tales of the hired man, the cortical centers and the old-brain centers were in full accord for the development of the pattern that took the boy to the fence. The old-brain patterns of flight were in charge, and the conscious experience was of an order fitting the dominance of old-brain activities. Such flight behaviors are basic to self-preservation, and the quality of conscious experience that accompanies such activity is not exclusively but only dominantly old-brain in nature. This interpretation is

verified by those occasions when people are "frozen" with fear or when they are so enraged that they do not know what they do.

Practical Implications of Old-brain and New-brain Coordination.—The preceding interpretation of the functioning of old-brain and new-brain areas seems to be verified by many experiences of everyday life. It is commonly understood that we do not think clearly when we are emotionally stirred; we say that our thinking is fogged with emotion. On the other hand, we can find among our friends people who spend much time thinking but are too complacent to know what action to take; we would like them better if they had more "drive." Still others represent those very practical people who do the right thing at the right time; they know what to do, and they do it. Such a type might represent a well-balanced coordination of old- and new-brain. Then there is our friend who thinks, knows what to do, but does not act. His thoughts turn back upon themselves; the cortical general orders of the day get to the thalamus, meet some tangle, and report back to headquarters without anything done, at which the general headquarters of the cortex again takes the matter under advisement. Another friend issues hasty orders from headquarters in the cortex, hasty orders that probably have arisen because of some minor state of activity in the thalamus, aroused by seeing or hearing some minor circumstance. Such a person spends little time in thought; hasty general orders are given, and the lower brain areas are left to effect the organization of details. Such a person goes enthusiastically into action, giving a commonplace incident the full backing of the whole emergency mechanism; then it turns out that the whole business was a "false alarm," and back to general headquarters goes the report of the venture, unsatisfactory in intelligent review and unsatisfying to lower brain areas which are left in conflict with the "higher-ups." These lower areas are constituted to resolve issues and to relieve stresses rather than pile them up.

Emotional Conflict in Modern Life.—There is ample evidence that the complex and strenuous pace of modern industrial life may be ill-adapted to the basic emotional nature of man. Put in terms of the foregoing discussion, the question is whether civilized life, which rests upon the inventiveness of the cortical areas, is working in harmony or in conflict with the natural patterns of the old-brain which is the seat of emotional experience. The evidence that points to the presence of a serious problem is found in the increase in the numbers confined in institutions for the mentally unbalanced, in the rate of increase in suicides, in the increase in juvenile delinquency, and in the increase in problems of sex behavior. To be sure, these are old problems; the most primitive social groups probably had many an individual who was prone to follow the dictates of basic behavior patterns rather than modify his conduct in keeping with the mores of clan or tribe. The methods of child training in various primitive societies that have been studied show wide differences in the emotional life of children who were the objects of the training.[1] One group may allow the greatest of freedom and depend upon the natural discipline of the play life of children in groups, whereas in another society there may be the strictest of parental domination of children's behavior.

The very complexity of modern life tends to excessive new-brain dominance. Through childhood and youth there continues a long process of education which has for its object the turning over to each succeeding generation of the cultural heritage of many past generations. Great bodies of organized learning await a child born into the world today, and the life of which he is a part is changing so fast that there continues to be a perpetual challenge to his capacity to make adaptations intelligently. Yet, as is commonly said, all this civilization is but a veneer, covering a biological human being whose stream of life is dominated basically

[1] Murchison, Carl (editor), *Handbook of Child Psychology*, Chap. 22, "The Primitive Child," by Margaret Mead, Clark University Press, 1931.

by old-brain areas, by an autonomic nervous system, by endocrines, and by the insistent demands of millions of active cells all of which rest upon long ages of evolution that make our short historical period but a thin front line on the forward march of time.

Summary: Emotional Behavior in Relation to the Total of Behavior.—Before considering in the next chapter the development of intelligent and conscious behavior, it will be well to have before us a summary of the physiological basis of emotional behavior and of conscious emotional experience.

1. Emotional behavior ultimately arises out of tissue needs. Hunger, thirst, self-preservation, and procreation bespeak an organism of tissues that has needs and tends to direct action to the fulfillment of these basic needs. The procuring of food, water, air, and warmth and the responses to pain and to the procreative impulses are fundamentally old-brain and emotional in character.

2. The blood stream is the first scene of action in the supplying of these needs; it is close to the life of the individual tissues. The life and activity of tissues and of the whole organism depend upon the maintenance of a complex balance in the content of this inner environment. Normal development of the human organism depends upon the balanced development of the endocrines. Basic metabolism, continued health, and the marshaling of forces for emergencies are conditioned by the balanced activity of hormones and related factors.

3. The autonomic nervous system supplies an order of control of basic organic activities that is a step higher than that of the hormones. This control is effected by a balance of excitatory and inhibitory impulses acting upon organs and glands of the viscera. In general the midsection or sympathetic division is balanced against the two end divisions, and when the midsection is dominant in emergency situations the activities under the control of the end divisions are halted. Through stimulation of the endocrines

and other vital organs the autonomic system is coordinated with the hormones.

4. Not only are the activities of endocrines and of visceral organs controlled by the sympathetic system, but they are subject to direct and indirect control of the central nervous system. From different levels of the spinal cord and particularly from the midbrain and medulla, there reach central nervous tracts that carry fibers to every important organ that is controlled by the sympathetic system. Through these connections the basic needs of inner life are brought into relation with the higher centers which control the actions of individuals in meeting these needs.

5. Outer circumstances vary; food is not always at hand, water and even air at times may be scarce, and there may be competition for shelter and mates. These varying conditions call for an adaptive life; they call for intelligent behavior that rises above the level of basic and emotional patterns. Up through the animal series increased provision is made for these activities through the enlargement and projection of the head end of the spinal cord, first into the old-brain areas of medulla, midbrain, and cerebellum and then into the superstructures of the cerebrum. The old-brain areas are the primitive overlords ruling over the lower centers of the central nervous system and the autonomic system and the endocrines. The patterns of behavior over which old-brain areas reign are primitive, but they are adaptive. Here is found the patterning of activities in which the inherited behaviors merge with intelligence of a basic order. Flight from snakes to fences, fight in which animal cunning is added to brute force, nest building that is done in barns and chimneys when the sheer sides of cliffs are not available—these are the patterns of the old-brain; they are emotional patterns, and the conscious experiences that arise from such patterns are emotions.

6. Another level, that of the cerebrum, becomes more in evidence as the organisms of the animal series become more complex and more adaptable. *Superstructure* is indeed the

right term for these cerebral developments. In the lower order of animals they appear as developments arising out of the olfactory lobes and certain other areas that are laid on the old-brain structures. In the higher animals, however, the main part of the cerebrum overtops these areas and rises on peduncles from the thalamus and the lower brain areas to ramify and become the dominant mass of the brain. They are superimposed in mass and in function, for through them man does his higher order of thinking. In these areas are organized the patterns by which man profits by his experience; through the patterns evolved in them his thought processes are directed in keeping with the generalizations that have been organized from his varied experience. Then, too, a different order of control arises from the product of the intelligent activity of these centers, for through them inventiveness has changed the whole scheme of life by changing the environment in which man lives. Where fire was feared, it is now made a servant; where wind and water once destroyed, they are now harnessed; wild animals are tamed, wild plants cultivated, and food supplies are made abundant and are stored; tools are used to build shelters, to till the soil, and to aid in combat. But, as a result, man finds that the inventiveness that made life more secure and satisfying has so increased its complexity that he may be quite as fearful as he was in his primitive state.

SUGGESTIONS FOR NOTEBOOK AND BULLETIN BOARD

1. Make a collection of 10 or 12 pictures, such as may be found in rotogravures, that definitely portray emotional behavior. Choose pictures in which facial expressions seem to reveal the emotional experience that the total picture makes apparent; use pictures of babies, children, and adults. Now cover all of each picture except the face, and then ask friends to name the emotion that the face supposedly expresses. After each friend has done this, reveal to him the total picture and get his interpretation of the emotion involved in the total picture

situation. Make a record of these paired responses, and note their agreement or disagreement.

2. Make a collection of news items that hinge upon emotional conflicts arising from lack of adjustment to modern life. This collection may well be supplemented with data showing increases over the last 20 or 30 years of admissions to institutions for psychopathic subjects. Such data may be secured from texts on mental hygiene. Can the cause of the difficulty reported in any of the news items be determined as maladjustments of endocrines?

DIARY OF YOUR OBSERVATIONS

1. Keep a record of several emotional experiences that you have observed, indicating for each the cause of the disturbance, its nature when most active, and the way in which it was finally resolved. Make an analysis of one such experience, giving your judgment of the part played by the cerebrum, the midbrain areas, the two parts of the autonomic system, the endocrines and basic tissue needs. Compare your appraisal with that of another student who has made an analysis of a similar experience.
2. Make a record of an experience, similar to that of the two boys with the blue racer, that reveals the difference between emotional patterns of behavior and the conscious emotional experience that comes as the reflective activity joins with the activity of nerve centers in control of the well-established emotional patterns. It may be possible to record several experiences ranging from an example in which the emotional pattern was so fully in control that the subject did not know what he was doing, to one in which the thoughtful pattern is but lightly tinged with emotional content.

SUGGESTED READING

1. Further reading on the various physiological activities involved in emotional behavior and conscious emotional experience should be helpful in getting a clear understanding of this important phase of human behavior. Chapter 10, "The Sympathetic Ganglia and Nerves," of Freeman, G. L.,

Introduction to Physiological Psychology (Ronald Press Company, 1934), is one of several chapters in this volume dealing with different topics related to our study. The chapter headings will guide the reader to other related materials; if but a limited time is available, it is suggested that the summaries at the ends of chapters be read.

Chapter Seven

Development of Intelligent Behavior and Conscious Experience

One day, Jimmie and Jane were watching the baby.

"Isn't he dumb? He can't do anything but stick things in his mouth," said Jimmie.

"He is not dumb," Jane replied with heat. "He's a smart baby. You were just as dumb as he is when you were little, and he'll grow up and be a lot smarter than you are."

Jimmie, of course, was teasing Jane; he was really much interested in his little brother and wished that he would grow up faster so that he would be a real playmate.

"But he does stick everything in his mouth," Jimmie insisted.

"He's only playing. He's already learned not to swallow things that he shouldn't," answered Jane.

"Look at him trying to walk! He can't walk as well as he can creep. Look at him stagger around."

Jimmie laughed at the baby, who had his legs spread wide as he made his way from one piece of furniture to another.

"Mother says he is a better creeper than you were; all you did was to hitch along."

Jane knew that she had hit on a subject that Jimmie did not like to have discussed. Just then the baby saw his red ball on the other side of the room and in his haste to secure it suddenly dropped to his hands and feet and scampered across the floor on all fours.

Jimmie made the most of this opportunity to divert attention from his own early methods of locomotion by crying, "Look at the bear cub! Bill's a bear cub; he walks like a bear!"

This picture of the Nelson children has in it an implication of the gradually widening acquaintance of each child with the world about him. As such acquaintance widens, his understanding deepens and he lives a fuller and richer life. The baby has a restricted world of his own, a very busy little world that centers in his physical needs and the maturing of basic ways of getting about in the world. Jane in her seven years has widened this restricted world and is an active participant, not only in the family life, but in the life of school and church, of childrens' parties, of stores, playgrounds, streetcars, trains, highways, automobiles, and innumerable other phases of a complex existence. Jimmie looks further afield than Jane, with an understanding that is in keeping with his greater age and experience. His interests have multiplied and broadened; each day he is making a most positive attack upon the world that faces him and stretches away into the more distant future.

Growing Interest in Early Life of Children.—More and more attention is being given to scientific research in the early development of children. It is becoming evident that behavior patterns established in this early period when the growth processes are dominant are quite as important as those of later periods when learning in the schoolroom becomes the center of interest. It is in the early years that the groundwork is laid for a child's individuality and personality in such matters, for example, as his sociability, confidence in himself, and disposition to take life happily and courageously or fearfully. There is a growing conviction that we have given too little thought to the developmental forces operating so markedly in the early years of a child's life. The study of early developments is often very valuable in giving us an understanding that would be difficult to get in any other way.

Basic Behavior Patterns of the Newborn Babe.—In Chap. VI there was occasion for noting the change in the emotional life of the babe in the first year. There were other accompanying changes which are worthy of more study, for they open the way to a better understanding of the growing intelligence of the child. It has already been noted that during the first weeks after birth the normal baby sleeps and dozes at least 20 hours out of every 24, a sleep broken with short waking periods. His whole existence is markedly passive, the organism apparently giving its energies to the adjustments that must be made to fit him for living in a new environment. The baby shows little of the behavior that will ultimately make him an active, useful member of the family. If we bear in mind the nature of his protected life before birth, the shock of birth itself, and the physiological changes that must take place as he adjusts to the new environment, it is plain that the primary business of these first weeks must necessarily be the adjustments and the development of behavior patterns that are most closely related to mere existence and self-preservation.

Some behavior patterns are ready formed at birth, though they have not functioned. For the first time the diaphragm contracts, ribs lift, and a lifetime of breathing is begun, with the lungs for the first time filtering oxygen into the blood stream and carbon dioxide out. The intricate business of maintaining a constant body temperature is the full responsibility of the babe, now separate from the parent body. Digestion and elimination are taken over by organs that up to the time of birth have had no essential part in the life of the fetus. With a relatively small amount of initial adjustment, the complicated activity of sucking and swallowing functions and an entirely new mode of obtaining and digesting food is set into action.

The sense organs of hearing, sight, taste, touch, and smell are well advanced in their development, but the stimuli of things seen, of noises heard, and of contacts with the skin must, for the most part, be unusually strong to

result in muscular response. This is due in part to the fact that the nerves to the sensory organs have not yet developed their medullary sheath, that outer coat of fatty substance that serves to insulate one nerve from another; hence, many excitations that are set up by outside stimuli are dissipated before they reach the motor nerves through which muscular action might be excited. It may be that this condition of the nervous system is a partial cause of the character of the muscular activity, for muscular response at birth and for some time thereafter is slow as compared with that of later periods. Movements are random, without the definite character that they later come to have. Sleep is a natural accompaniment of this low sensitivity. The baby needs time, food, fresh air, and a protected existence for the adjustments and maturation of these newly functioning behaviors.

Expressive Activities in Early Infancy.—There are certain fairly well-defined but rather random activities of the baby that do not seem to arise in direct response to outside stimuli and are not directed toward any outside situation. He flexes his arms and legs, he stretches, and his eyes move about in an aimless manner. He hiccups, sneezes, yawns, smiles, and on occasion shivers. These activities are for the most part outward expressions arising from inner organic conditions. There is of course a relation between these expressive activities of the infant and the changing conditions of his environment. The tickling nose that starts a sneeze may be due to a draft striking some part of the body, and shivering is nature's means of generating heat through muscular activity when the body temperature threatens to fall below normal. As for the smiles of the baby, they really are not directed in this early period toward the mother, disillusioning though the idea may be, but like the sneezes arise from inner conditions of the organism.

Early Responses to Outside Stimuli.—The newborn babe responds to stimuli from without, but his responses are very general in nature. The whole body of the baby gets involved

in activities such as the turning of his head, moving his arms, and wriggling his toes. Pinching a baby's toe produces a generalized response that involves all of his body in uncoordinated movement. In the young infant almost any stimulus may evoke almost any response. There seem to be two tendencies in the basic behavior of young infants that we should note particularly. One is the tendency for the whole organism to respond, the response being most marked in that part which received the stimuli and grading off in intensity in other parts of the body. The general character of these responses reminds us of the behavior of the ameba and the jellyfish. If you pinch the babe's toe, you will probably get a vigorous response in that foot, less active response in the arms, and a degree of sucking activity. If you give him a drop of salty water, he will probably eject it with vigorous activity of the mouth muscles and at the same time register his objection with random leg and foot movements. You may be sure that as the weeks pass these general responses will become more specific and purposeful. A second tendency is for a response to reinstate an activity that has just previously held the center of the stage. If the babe has been nursing and has stopped and his toe is then pinched, he may resume his nursing again.

Discrimination in Early Responses.—Though the baby's behavior tends to involve his whole body, nevertheless his responses are purposive in nature. The early responses are closely related to basic needs; at times considerable discrimination is evidenced in them, and more discrimination soon develops. The first time that a nipple is placed between the baby's lips, the sucking response may not be immediate or by any means perfect, but it quickly improves with experience. In his food-getting activities, the infant shows considerable discrimination in taste and temperature. He rejects his milk when it is a bit too cold or too hot or when its flavor has been changed. He spits out anything that is salty or bitter. Strangely in contrast to this discrimination, which is in evidence when he is hungry, he will at other

times put all kinds of articles into his mouth and will suck these things as though food were forthcoming. Other ways of getting food will be needed before many months have passed, and this playful activity appears to be a part of of a development to meet future needs. Other examples of this development from the general to the particular are found. Most babes will turn their eyes in a random way toward bright light. At birth or shortly thereafter the pupillary reflexes that control the size of the pupil of the

Early Reflex Patterns

Very young baby grasps fingers and is lifted; note the toes spread upward and outward. (*From L. C. Wagoner, The Development of Learning in Young Children.*)

eyes act and act together; that is, they will respond in unison even though only one eye received the stimulus. It is several days after birth, however, before the two eyes will turn in unison toward the light, and it is generally in the third week or later that they will remain fixed upon it for any appreciable length of time.

Some patterns that are definitely organized at birth do not long continue in their original state. When the soles of the feet of the newborn babe are touched, the toes will turn upward and outward, but within a few weeks and for the remainder of his life the same stimulation causes him to

turn his toes downward. Many babies at birth will grasp a stick firmly when it is placed in their hands, and some will retain their hold for as long as 1 minute while they are lifted by the stick to which they cling. They soon lose this ability, perhaps because they have no need of exercising it.

These early responses to outside stimuli are parts of behavior patterns that are established before birth or develop soon after birth. These and other patterns of similar nature are the basic patterns of the species that have been essential to the existence and protection of the young for many generations. Their development after birth as before birth proceeds through a process of differentiation in which specialized responses develop from more general responses.

Complexity of Basic Behavior Patterns.—It is only natural that our interpretation of any behavior should be colored by our adult point of view; when we observe the behavior of the babe, we may wrongly infer that what comes with little effort or conscious concern on his part must be simple. As a matter of fact, these basic behavior patterns are not simple but decidedly complex. Sucking, for example, involves a surprising amount of highly coordinated activities in what appears at first to be a very simple pattern of behavior. Pursing lips and contracting muscles of tongue and cheeks and throat are required, and these various activities must be timed rhythmically, one part with another, to produce the effective whole. Much more than these immediately related activities is involved in sucking; the whole body must lend itself, at least to the extent of being passively disposed, to make the activity possible. Indeed, the initiation and continuance of the activity depend ultimately upon the whole organism; for the babe refuses food when he is not hungry, he cries for it when he is hungry, he rejects the nipple when he has had enough, and between feeding times he makes a play out of the activity by a seemingly aimless mouthing of all sorts of objects. These basic behavior patterns are not only complex but adaptable, and they may become even more complex as

they change to meet the conditions of advancing stages of development. As the baby grows older, some of these patterns disappear or are modified as new ones arise that are more appropriate. These developments are best interpreted when viewed over the early years, the comparatively long period showing the significance of the early stages which lay the basis for the child's later ability to feed himself, walk, talk, and become otherwise independent.

Further Evidence of Whole-to-part Development.—Coghill[1] and others[2,3] who have studied movements of the young of lower animals as well as human fetuses find that the first movements of the developing organisms are movements of the whole body. The development of the first swimming movement of the salamander supplies a good example of this development from a simple movement of the whole body to more complex movements. The swimming movement develops out of a flexing of the whole body, an activity that preceded the development of the swimming movement. The new activity begins at the head as in the flexing and proceeds toward the tail, but before it reaches the tail a second flexure in the opposite direction is started and is proceeding tailward before the first one has been completed. As the limbs develop, they move at first as part of the swimming movements of the trunk, but in time they attain a degree of independence that gives the salamander a high degree of adaptability in swimming. Needless to say, these differentiated activities are maintained in relation to the larger whole of which they are a part.

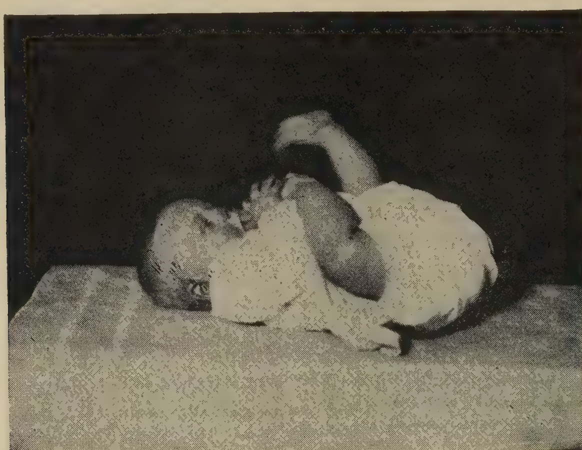
Study of the development of behavior in the prenatal period and infancy of human beings gives clear evidence that it is a whole-to-part development, with the more

[1] Coghill, G. E., *Anatomy and the Problem of Behavior*, The Macmillan Company, 1929.

[2] Windle, W. F., and A. M. Griffin, "Observations on Embryonic and Fetal Movements of the Cat," *Journal of Comparative Neurology*, Vol. 52, pp. 149–188, 1930.

[3] Hooker, Davenport, "Early Fetal Activity in Mammals," *Yale Journal of Biology and Medicine*, Vol. 8, pp. 579–602.

specific behaviors differentiating from gross generalized patterns. Countless examples might be added to parallel the development of swimming in the salamander. At first, the baby's hands and arms wave wildly in the air as he attempts to grasp a toy held out to him. Later, the reaching is more coordinated but with the activity involving the whole body, as may be seen when a desired object is held above the child lying on his back. Feet and legs as well as arms are extended toward the object, and even the head



Activity Involving Whole Body

Baby uses head, arms, legs in holding an object. (*From L. C. Wagoner, The Development of Learning in Young Children.*)

lifts; the baby's whole body is involved in the effort to secure it. In time, he will reach with only the two arms and hands, and the movement will be accurate, with no loss of time in taking the object into his hands. Still later, a single extended arm and hand will be used if the object can be so handled.

Any adequate generalization of the development of these early behavior patterns would include the following considerations: (1) The whole organism, in one way or another, is involved in early activity. (2) A certain response may be evoked by a wide range of stimuli, and a certain stimulus

may evoke many different responses. (3) The beginnings of discrimination and specific response are found at birth, as shown in the pupillary reflexes and in the babe's rejection of milk that is slightly too warm or too cold. (4) The behavior improves with experience through the differentiation of more selective responses. (5) Not only are these behaviors modified by experience, but they may disappear when other patterns of behavior are more appropriate to the developing life of the child; in other words, the differentiated behaviors maintain their relations with the whole organism.

It should be noted at this time that the same basic principles that govern development before birth are still operative in the early behavior patterns after birth. Innate growth potentials are evidenced in the general nature of the behavior patterns; the baby's mode of food getting is patterned after his kind, just as the pecking of the newly hatched chick is appropriate to its kind. The principle of "All for each and each for all" still holds; the parts maintain their endless activity as specific functions, but they carry on their activities in balanced relation with the endless activity of other parts. As in prenatal development, these activities have meaning only as they are interpreted as a part of the drama of life which centers in the maintenance of relations between organism and environment.

The Emergence of More Intelligent Patterns of Behavior. The maturation of behavior patterns that are essential to existence is followed by the emergence of many other patterns that imply much more than mere existence. In all these developments the whole behavior of the child is lifted to a higher level, until, as Jimmy and Jane found in their little brother, another intelligent being is added to the family circle. The beginnings of this development are unpretentious; as Jane told Jimmie, what appears to be unintelligent must be seen in relation to what has gone before and what will surely make its appearance in the future. The emergent character of this development during

the first year of life is seen in the following description which indicates what may be expected of children of the ages of two, five, and eight months when a towel is placed over their faces.

At two months "you will find that the youngest, displaying all the movements that he is able to produce, tries with all means to get rid of the towel. The whole set of reflexes from top to toe is aroused. At the same time the child may not cry. But despite all his efforts he is not and cannot be successful." At the age of five months he "will develop organized and directed movements instead of the chaotic and undirected reflex action. He will grasp with his hands in the direction of the towel and sometimes, though with much effort and pain, he will even be successful in drawing it away." Then what a difference we find in the child of eight months of age who "will show neither effort nor pain, but will grasp and draw the towel away, maybe even in a laughing and playful manner. His movements are not only organized but at the same time straight and easy."[1]

In these word pictures of children of different ages, we have a record of development from unregulated movement involving the whole body to neatly directed and executed movements of only those parts of the body that are necessary for meeting the situation. Here we see a development from a negative and unintelligent response to a comprehension of what is needed and a ready organization of actions that bring results. We find recorded here the development of playful attitudes that accompany the maturation of newly emerging activities. These attitudes of playful experimentation, which appear in what Bühler calls "spontaneous reactions," constitute one of the best approaches to an understanding not only of the maturation processes that lay the basis for intelligent behavior, but also of the modification and control of the primitive emotional responses.

[1] Bühler, Charlotte, *The First Year of Life*, p. 10, The John Day Company, Inc., 1930.

Spontaneous Playful Reactions.—Spontaneous responses to situations come to occupy the greater part of the active wakeful life of the child. Indeed, before the end of the first year he is spending nearly one-third of the 24 hours in this experimental type of play activity. During the first month less than a half hour is given to such activity. But the second, third, and fourth months average more than 2 hours, and in the next 4 months the time has increased sharply to 5 hours or more. During the last 4 months of the year, between 7 and 8 hours out of the 24 are spent in such activity. In other words, by the time the baby is ten months old he is putting in a full working day of 8 hours at play.

This play time was once a part of the hours given to sleep and dozing. Month by month throughout the year, the averages for sleep, dozing, and spontaneous reactions sum up close to 20 hours. As may be seen from the accompanying table, the time devoted to spontaneous reactions increases, for the most part, at the expense of time devoted to sleep and dozing.

Approximate Hours of the Twenty-four Devoted to Different Types of Behavior at Different Periods of the First Year
(A condensation and rearrangement of data from Table XXI, p. 135, of Bühler's *First Year of Life*)

Period of the first year	(1) Sleep and dozing, hours	(2) Spontaneous reactions	Sum for columns (1) and (2), hours	(3) Negative reactions, hours	(4) Positive reactions, hours
1st day..............	21	(14 minutes)	21	2	1
1st month............	18	(24 minutes)	19	4	1
2d to 4th month.....	17	2 hours	19	3	2
5th to 8th month.....	14	5½ hours	20	2	2
9th to 12th month....	13	8 hours	21	1	2

These spontaneous activities are play to the baby; he gets pleasure out of them. He spends so much time in this way and keeps so persistently at it that we must look upon this play as having more than casual significance. This pleasur-

able play enters into all kinds of situations. The sucking behavior has its obvious practical purpose, but, as has been noted earlier in this chapter, the babe puts almost everything that he grasps into his mouth. When he is hungry, he will of course not be satisfied with his finger or a rattle, but it is plain that at other times he gets much pleasure from mouthing all sorts of objects. The character of movements and the time and energy spent in this way go far beyond what might be expected for the maturing and perfecting of the sucking behavior itself, and we conclude that this play leads out from the fields of the immediate usefulness to activity that may be the foundation for developments of a quite different nature.

It is interesting and profitable to note the development of spontaneous activity in several other kinds of behavior. In the first 2 months the child has done much vocalizing in his screaming and shrieking, the patterns for which are well established at birth. The character of the screaming changes into well-sustained crying that has begun to be intelligent so that parents understand from the nature of the crying what the trouble is. At about the age of two months the child begins to listen to some of these sounds of his own voice and begins to repeat some of them. From this time on, there are more and more of babbling repetitions and more and more of variation in them. The babe is at the same time noting more and more of the sounds that occur about him. He mimics his own sounds and those of others. The things he handles bring about sounds; the experience of eyes and ears and hands and mouth come into play in the same experience, and things seen and heard and felt come to mean more because of being so related. He comes to live the sounds he makes vocally in relation to people, things, and events, and after a time he is saying single words that mean whole sentences and stand for total situations. The word "mamma" or perhaps a bit of jargon of his own chance invention may be a demand for something to eat or an impulsive request to pick up the rattle that he has just

dropped. These are the beginnings of language. Noting these meager beginnings and the playful development that follows, we may better understand the more conscious and intelligent use of language that is so distinctly a part of human life.

Another example of early maturations is seen in the handling of objects and in the control of the muscles of posture and body movement. We have noted that there are a few definitely formed reflexes at the time of birth, but the greater part of the behavior is so impulsive and varied, so uncoordinated and random, that it is difficult to follow the child's activity closely enough to get a description of it. Let us note, for example, Bühler's record of random activity of a boy of thirteen days:

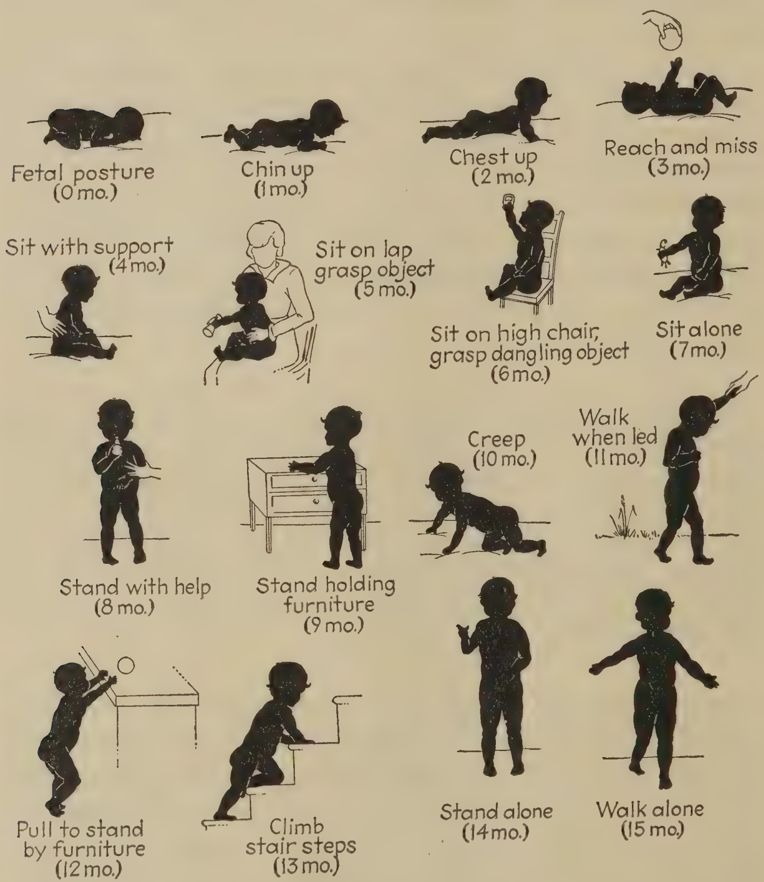
B70. The little hands are slightly balled; the little arms, which are likewise just a little bent, travel about in the air; one goes away from the chin, the other at the very same time hits the chin; all fingers are in movement. The first three fingers of the right hand are curled in, the other two at the same time are stretched toward the back of the hand. The fingers of the left hand flutter aimlessly about without any sort of plan, each moves for itself, to and fro, in its own tempo.[1]

Objects are first grasped only when they come in contact with the hand by chance, which then closes upon them, and the grasped object is generally brought to the mouth. The two fists and the two feet and legs may be found later to be used at the same time in the first coordination of arms and legs in handling objects for brief moments, a strange kind of crude juggling act in the eyes of adults. Still later, things that are seen are reached for and grasped with much precision.

The ability to handle the body and particularly the ability to secure and maintain an upright position are significant in bringing the baby into contact with the world

[1] *Ibid.*, pp. 77–78.

about him in an effective manner. The average child[1] will stand with assistance at the eighth month, but not until the fourteenth month will he stand alone. He was in his



Postural Development of Infant.

The characteristic postures and activity of each of the first fifteen months. (*From M. M. Shirley, The First Two Years, Vol. II, University of Minnesota Press*, 1933.)

seventh month before he was sitting upright. In his sixth month we would perhaps have found him changing position

[1] The reader will have noted many exceptions; averages represent large groups, and exceptions are to be expected.

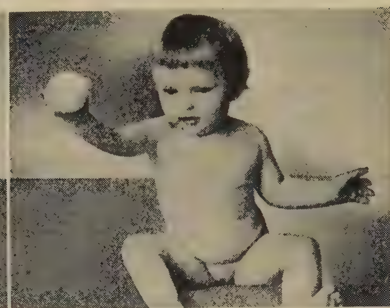
from lying on his stomach to lying on his back, and we might also at that time have found him raised from the position on his stomach, with head and shoulders and adjoining trunk lifted, possibly supported by one arm while he reaches for an object with the other. He was nearly three months old before he could lift his head and chest when lying on his stomach, and before this there was a time when it was a real achievement for him to turn his head in a purposeful manner; his eyes turned toward objects he saw, before his head could turn.

Playful Activity as the Normal Means of Maturation.—The position that the babe prefers is the one last mastered, and it is on these last-mastered positions and activities that he spends most of his time in spontaneous play. They are to him as new toys to an older child; they take his attention until a newer activity comes to take the place of the old. With passing months the new accomplishment upon which he practices in his play may be pursing his lips, grasping the fingers of one hand with those of the other, trying to shove a ball into his mouth, beating the side of his crib with a rattle, trying to pull the rattle apart, twisting and turning his body, babbling, crowing, making clicking sounds with his tongue and lips, holding the side of the crib while he moves his feet up and down, creeping, pulling himself upright at chairs, or any one of his other innumerable new activities. Eight hours of the 24 are spent in this busy, playful business of maturation of one pattern after another.

The babe is bringing order out of chaos as one pattern of behavior after another is developed. He specializes now in one newly developing experience and now in another. Thus he becomes more capable of doing one thing at a time instead of doing everything at once in a mass of random movements. What appears to be the simplification of behavior really is evidence of increased complexity, for many activities that were once random are now halted while the specialized activity is permitted to take the center of the stage in experience. The total pattern is

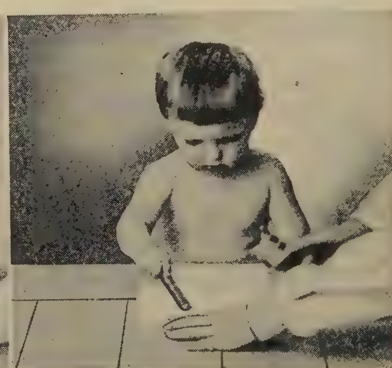
Behavior Becomes Specialized

Two hands at 40 weeks.



One hand at 56 weeks.

Two hands at 36 weeks.



One hand at 56 weeks.

Pulls string on ring.

Work for each hand.

(At 44 weeks.)

(*From A. Gesell and H. Thompson, Infant Behavior.*)

brought under better control through the differentiation of one pattern of behavior after another. Increased control is brought about through increased organization, which in turn implies increased complexity of the total behavior of the organism. In this setting we find the babe becoming more conscious of what he is about. The learning processes are becoming more dominant in the scheme of adaptation. He is beginning to do things to his environment. He is becoming a more intelligent human being. His life is raised more and more to a conscious level, and in a few years his parents will be marveling at the brilliant achievements as their child distinguishes himself in ways they had never dreamed of.

Development through Growth, Maturation, and Learning. Life is a continuous process of adaptation. Environment presents a continuous stream of changing circumstances; and to the changing conditions of life without, the dynamic organism adapts from within. Its adaptations take place through the processes of growth, maturation, and learning. Growth comes through the addition and differentiation of new tissues. It takes time for new tissues to form and more time for organs to come to their full functional ability through the processes of maturation. Throughout life, to old and young alike, life presents new situations that call for continued adjustment through the process of learning. Growth, maturation, and learning are different phases of the lifetime of changes in the organism that fit it for relations with environment.

Intelligent Behavior.—In the preceding discussions we have been concerned with the emergence of patterns of behavior that are common to human beings. The normal processes of growth and maturation bring these patterns into being, and these patterns meet the basic needs of life. All the situations of a changing environment cannot be anticipated in basic patterns of behavior. Basic patterns may take care of eating and digestion, but the procuring of food may challenge to the utmost the ingenuity of the

individual. The world does not present the same problems to all people in the same ways, and different people have different capacities for finding ways and means of effective living. Such adaptations, made outside the general pattern of human behavior, constitute learning. Behavior that results from learning we call *intelligent behavior*. Intelligence is the capacity to learn; learning is the process of adapting to novel situations, those situations for which the general patterns of behavior that arise through the processes of growth are not adequate.

The situations that are met on the level of autonomic, reflex, and instinctive behavior involve little or no learning and require little or no intelligence. These basic patterns are remarkable organic creations; but to the degree that they come ready-made through the normal processes of growth and maturation, we do not think of them as intelligent. There are, of course, all degrees of the unusual and novel in the situations an individual must meet, and there are all degrees of difficulty in the adaptations made to meet these situations. We have, therefore, come to speak of these levels of ability to learn, as *levels of intelligence*.

Learning Is a Process of Emergent Adaptation.—In experience the usual is always mixed with some degree of the unusual, and various levels of behavior are involved in meeting situations. It is impossible to tell where growth leaves off and maturation begins; the learning processes are joined with growth and maturation in a unified development. Early in life, the child begins to reach for things; later, he begins to walk; and then he may be soon found climbing chairs to get into cupboards. Such an exploit is told of Jimmie when he was much younger than now, and in this narrative we see how growth merges into maturation and maturation merges into learning to bring his ability to a level adequate for the performance. Hunger was as native to Jimmie as to any child; his reflexes for balance had developed, and his walking and pushing and climbing of chairs had matured to a stage adequate for the venture. He

had learned that jam satisfied hunger, that it pleased even when he was not really hungry; indeed, the sight of it generally made him dissatisfied until he had some of it. On this particular day, the stage was set in the outward circumstances of jam that could be seen in the cupboard, and inwardly the stage was set through the products of growth, maturation, and learning. Then came the first journey to the jam, emergent from the setting of outer and inner circumstances. This was an adaptation indeed; jam was spied on the cupboard shelf, a plan of action was conceived in a flash, and forthwith child, chair, cupboard, and jam were related in an orderly pattern of behavior as the chair was pushed to the cupboard, the child climbed to the chair seat, then to the waist-high ledge of the cupboard, and thus to the jam. Jam in hand, Jimmie came to rest on the ledge, to discover that it was a long way to the floor. He had reached the level of present capacity; he had got up but could not get down, and presently he reverted to a less ingenious means of meeting a difficulty by crying for his mother to help him down.

Who would attempt the complete untangling of levels of behaviors in such a performance? When we recall that these adaptations are the organism's means for maintaining the unity of its life, is it not reasonable to find growth, maturation, and learning merged in the developments that make jam getting a unified performance?

Although these adaptations result in this very practical unity, they nevertheless always present two aspects to the observer. Looked at from one point of view, jam, chair, and cupboard are seen as the starting point in Jimmie's enterprise; they are seen as the situation without, which initiates the activity within. Looked at from the other point of view, the performance is made possible only through the activity of the boy, activity that is persistently exercised in one way or another, day after day and month after month. This active boy is a product of years of growth which have added new tissues to old, which have led to the differentiation and

specialization of tissues; maturation has brought the developing organism nearer to maturity; added to these, learning has had the result that Jimmie knows and does many things. He has learned the use of chairs and cupboards, learned to climb chairs, learned that jam is good to eat; and, finally, he has learned something of himself in relation to chairs, cupboard, and jam.

These various adaptations are always directed to situations without. Breathing is senseless without air; dust in the eye makes blinking purposive; family life of the present and possibly of the future gives point to playing with dolls in childhood; chairs and cupboards are the occasions for climbing. Jam without and, within, hunger and appetite and the ability to climb join in setting the stage for the creative pattern of behavior found in Jimmie's new enterprise. Life at all levels seems to be relational in its nature; growth, maturation, and learning are different aspects of the continuous process of establishing working relations with the world without.

Complexity of Organization as the Basis for Consciousness.—What would have been the chance of Jimmie's getting the jam if he had been asleep or dozing or daydreaming? Little chance indeed. We think of such performances as coming with vivid awareness, with the child fully conscious. The outer conditions of Jimmie's exploit had been present before, and they had not stirred him into this state of activity. Not until jam and chair and cupboard and himself were conceived in relation did this performance result, and with the patterning of these factors in relation there was heightening of consciousness. Our common experience tells us that consciousness generally accompanies our most intelligent adaptations. When we are asleep, we are not conscious, and as we awake we feel ourselves "getting organized." As we come from under the influence of an anesthetic and regain consciousness, we are apt to ask, "Where am I, what am I doing here?" We are bent on setting ourselves aright in strange circumstances. Dreams

seem to be traces of conscious experience that persist in sleep. They are generally lacking in organization, and when we awake we may find ourselves trying to get them organized into a sensible pattern. When we are dozing, half awake and half asleep, our experience is poorly defined, hazy, and the form and organization that appear at times do not long continue. Sometimes when awake we daydream; though this experience is better organized than dreams, there is much that is lacking in the clearness of its form and the definiteness with which it moves along. In daydreams we find ourselves somewhat cut off from the realities of the outside world. When we are fully conscious, these realities seem to insist that something be done about them and our behavior is apt to be organized and purposeful. When we come out of our dozing or daydreaming, we sense the difference between such experience and normal conscious life which, if it does not already have clearness and organization and purpose, seems to be tending toward such a condition.

Some Intelligent Adaptations Are Made without Conscious Direction.—We very naturally think of conscious direction as accompanying learning, but it would be wrong to conclude that the patterning of intelligent behavior can take place only when consciously directed. We expect growth to take place without our being conscious of it, but we find that we also learn without our knowing it. The remarkable growth and development that take place before birth probably arouse little awareness, and all through life many adaptations are made to the new and novel without our being aware of them. Jimmie and Jane weigh on scales and measure their height to find that they have grown, though they have not been aware of it. They compare what they do today with what they did a month ago in writing and arithmetic to find that they have not been aware of how much they have learned. With the appearance of the first ice of a new winter they put on their skates to find that they can skate better than the winter before. There is ample verification for the famous saying of William James that

"we learn to skate in summer and learn to swim in winter.[1]"

Sometimes we solve our problems when we are asleep. A geometry teacher used to tell me that if I carefully studied a hard proposition just before I went to bed, I might expect to get up in the morning and solve it with much less work than would otherwise be required. Swift[2] reports the case of a sales manager who early in a day's business quoted the wrong price on a large order of goods, the quotation being exactly half what it should have been. He went about his business and other affairs for the remainder of the day without giving the transaction a thought; then in the middle of the night he awakened to find himself in the act of reaching for the electric light switch, bent on correcting the error. The whole matter was now clear, even to the cause of the mistake in computation; the pattern had reorganized during his sleep, reorganized in a manner to awaken him.

Dearborn reports the experience of the French mathematician Poincaré,[3] in which is found again the evidence of learning proceeding when the learner is not giving it definite attention. Poincaré was thoroughly acquainted with two mathematical systems of thought, and one evening when he had taken a cup of black coffee at dinner and could not sleep, the possibility of establishing the relations between the two systems gradually took form. The issues involved came clearly before him at that time but seemed too difficult for solution, and having decided there was little use in considering them he dismissed them from his thoughts. Several steps in the solution came to him long afterward at moments when he had not been thinking about them. They popped into his consciousness, much as Jimmie's suddenly conceived jam exploit, once when he was about to enter an omnibus, again as he was crossing a

[1] James, William, *Principles of Psychology*, Vol. 1, p. 110, Henry Holt & Company, Inc., 1890.

[2] Swift, E. J., *The Jungle of the Mind*, p. 224, Charles Scribner's Sons, 1931.

[3] Poincaré, H., *The Foundations of Science*, p. ix, The Science Press, 1909. Used by G. V. Dearborn, *How to Learn Easily*, Little, Brown & Company, 1916.

boulevard, a third time on a geological excursion when the conversation was concerned with everyday matters that had no relation to mathematics.

Old Patterns Organized in New Relations to Make New Wholes.—It must be admitted that in all the cases noted above the stage was set for new learning to take place, and the question may therefore be raised as to what new factor accounts for the new pattern of behavior. The mathematician was well acquainted with every element that went into the new formulations. Jimmie was acquainted with jam, chair, and cupboard and had done much climbing before. The teacher of geometry emphasized in her directions that the student should recall all that he knew about the difficult proposition before he retired. The sales manager had had before him during the day every element of the price-quoting experience, including the one factor that resulted in making the quotation half what it should have been. He had found it convenient to use half the stock on which the quotation was based and had forgotten to double the result of his computation. The whole experience was seemingly satisfactory as he went forward with the business of the day—then in the middle of the night a new pattern was formed with the forgotten factor included. With the forming of the new pattern, he was as vividly intent on action as Jimmie when he conceived the way to get to the jam.

Whatever there may be of the old in such experiences, when the old elements are formed into a new pattern or organization a new adaptation results. New pattern and new organization of experience account for Jimmie's jam getting; they account for the formulation and proof of the mathematician's problems, for the solving of the geometry problems of the high-school student, and for the corrected error of the sales manager. We may or may not be consciously directing the organization of such new experiences, but with the final patterning there come wakefulness where there was sleep and vividness where there was mere wakefulness or consciousness.

Wakefulness, awareness, consciousness, vividness—are these not degrees of mental experience that arise from and accompany the new patterning and organization of behavior on the level of learning? With this question before us, let us turn to the problem of the origin of conscious experience.

Interpreting the Conscious Experience of Others.—Conscious experience is something that cannot be observed directly by others than ourselves, but facial expressions and other behavior are almost universally accepted evidences of conscious experience. We know that the pupils of our eyes adjust to changes in intensity of light without our knowing it, and we infer that others are not conscious of their pupillary reflexes. Their report of their experience would certainly correspond with our own. If we are confronted with a puzzling situation, we find our conscious experience changing with the developing situation and our changed activity. As we pause to consider some way of solution, then go about this solution in a characteristically straightforward manner, then finally see our plan work out or perhaps fail, we find each step of the behavior accompanied by different kinds of conscious experience. When we observe others behave in the same manner under similar circumstances, we feel warranted in thinking that their conscious experiences are similar to ours. We come to believe that our inner experiences are too easily revealed by our expressions and behavior, and we often invent mannerisms that tend to cover up our feelings and thoughts and even simulate behavior to mislead observers. When we speak of sharing experience with others, of understanding others and sympathizing with them, we are adding further evidence of this universal interpretation of conscious experience from outer expressions.

Old and New Interpretations of Consciousness in Infants. If there are limitations to one adult understanding the conscious experience of another, there are certainly greater limitations to adults understanding the conscious experi-

ences of children, particularly those of infants. Let us compare briefly some of the notions that have been held about the conscious life of babes, some of which are now discarded. More than a century ago the English associationists thought that the inner life of newborn babies was like a *tabula rasa*, that is, like a tablet on which no mark of experience had as yet been left. This point of view is of course quite out of keeping with the fact that there are well-formed patterns in newborn infants which may be expected to arouse some kind of inner experience, however ill defined it may be.

The spontaneous and uncoordinated activity of the babe and his obvious inability to use many of the sensory organs may have been the basis for the theory that the inner life of the newborn child was a buzzing confusion. But all the behavior of the babe is not in support of such a notion; indeed, it is contradicted by careful observations such as those made by Bühler which emphasize the large amount of sleep and dozing and the considerable amount of quiet, neutral, and seemingly contemplative behavior of the child's waking hours. Then, too, his negative, protesting behavior has much of purpose in it when we view it as a part of the inherited plan of self-preservation. The more or less definite nature of the patterns of reflexes and instinctive behavior is also out of keeping with this notion of confusion. Just as adults are not aware of the activity of reflexes, so it might be presumed that the basic activities of the newborn babe will not cause any high degree of consciousness, buzzing or otherwise.

Some modern psychologists refuse even to consider the conscious aspect of experience, asserting that since we cannot know what happens in the minds of others and certainly cannot know what is in the minds of babies, it is useless and may be misleading to build upon such conjectures. Some behaviorists take this point of view but find it difficult to describe and interpret human behavior, without reference to these mental aspects of our experiences. Their very language often betrays them, for it is hard to describe

human behavior without using words that imply conscious experience.

A reasonable point of view of consciousness is taken by Koffka[1] and by Bühler,[2] whose differences in interpretation are lost in their general agreement. Their conception of developing conscious life is based on careful observations. Developing consciousness is looked upon, not as something apart from behavior, but as a natural manifestation arising from the organization and development of complex patterns of behavior, particularly those on the intelligent level. Consciousness, as looked at in this manner, becomes a matter of degree, it thus being possible to grant primitive forms of awareness to very low orders of behavior, whether these be the behaviors of man or animals. Koffka warns us against the mistake of surmising that the baby's conscious experience is closely like that of the adult. Differences both in level and in kind may be inferred from observations of differences in the character of the observed behavior. If such differences between the adult and the baby are acknowledged, there still remains much that may have some similarity, in such experiences as the awareness of hunger, of having had our hunger satisfied, of being refreshed, and of being fatigued. Such similarities provide some basis for interpreting behavior, not only in terms of what we see, but likewise in terms of probable conscious experience. The facts, however, should warn us to be careful that we do not read our own experience into that of the babe.

How Being Awake and Aware Develop into Consciousness.—Consciousness may be interpreted as arising with the differentiation of definite parts of experience as they are set off against the less organized state of mere awareness; this is another way of saying that consciousness arises with the better organization of experience in which some parts

[1] Koffka, K., *Growth of the Mind*, pp. 139 *ff.*, Harcourt, Brace & Company, 1928.

[2] Bühler, *op. cit.*, pp. 48 *ff.*

Out of sleep. Just awake. Now aware.

(*Life Magazine.*)

Degrees of Consciousness

gain a dominance over other parts. It is not to be expected that in the development of an infant there will be a sudden change from awareness to definite conscious patterns. Indeed the evidence seems to point to a gradual development. Data taken from Bühler[1] indicate the setting in which awareness might first develop into a definiteness that warrants the name of consciousness. This evidence is similar to that which may be observed in the life of almost any babe, with of course some variation according to the age of the child. It is not until the second month, and many times not until the third month, that expressions such as wrinkled forehead, movements of eyelids, and vocal sounds are found definitely accompanying other behavior, such as looking intently at any object. It is such expressions as these that we usually accept as indicative of definite attention. The term *attention* means the dominance of one aspect of experience over the remainder. In the third month the babe first makes orderly movements toward things seen or heard. Such behavior indicates definitely where his attention is; it indicates a definite organization of his experience. An indication of a new stage of consciousness appears in the fourth month when the infant uses two or more sensory organs together; simultaneously he looks at and listens to a rattle; he gazes at his own moving hands, in apparent wonderment at finding that the fingers that he moves are the same things that he sees moving. Not until the fifth month will he coordinate purposeful movement with what he hears because of the movement, as, for example, when he shakes a rattle to which he listens.

The Probable Nature of First Conscious Experiences.—From the evidence thus far given, it appears that the dominant character of the first days of life is one of no awareness when asleep and of diffused and undifferentiated awareness during most of the waking periods. Behaviors on the reflex and instinctive levels probably take place with low levels of awareness; we see the babe nursing when he is

[1] *Ibid.*, pp. 44–73.

dozing or half asleep. Outside stimuli at first beget a definite response only when they are strong, and such stimuli arouse activity that is poorly organized and of short duration and continuity. The conscious states that accompany such experience are probably hazy and ill defined, arising out of a more diffused and unorganized state of awareness which may be somewhat like the experience of adults when dozing.

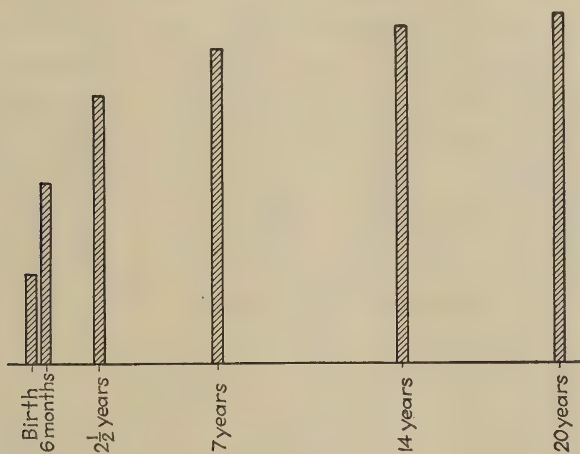
This interpretation leads us to think of a sound heard or of any sensory experience that can break through into this primitive consciousness as appearing against and taking form out of the diffused state of awareness which continues to form the background as an integral part of the total experience. For example, the babe may be awake, the activities essential to life go forward continuously, reflexes of various kinds are observed along with more complicated behaviors, such as the sucking of a thumb. With all this there may be no evidence in facial expression of any more than mere wakefulness and awareness; seemingly there is no phase of the child's experience sufficiently dominant to bring about any well-defined, continuous behavior. Then a sharp sound occurs, and facial expression and other behavior give evidence that the sensory presentation thus aroused dominates the child's experience. His random movements are arrested; he wrinkles his brows, lowers his eyelids, and persists for some little time in what we commonly recognize as an attentive attitude. Such commonly observed behavior seems to be in harmony with the interpretation of developing consciousness as the organization of experience with one phase of it dominant and set against a background of less organized phases of the total behavior pattern. This interpretation is further verified as we consider the nature of sensory presentation in the following chapter.

Brain Development that Accompanies the Development of Consciousness.—When one turns to the physiological development of the nervous system which takes place at the time that conscious behavior appears, one finds much that

throws light upon the changing experience of the babe. At birth the spinal cord is well along in the structural development necessary for handling reflexes, and with the maturation of these parts these reflexes come to function with precision. One tract only in the cord is not fully developed, that which carries the motor impulses from the cortex of the brain through the cord to the muscles of the body. The lower brain areas parallel in general the development in the cord. The higher brain areas in the cerebrum are in the early stages of organization and development, even though all the nerve cells that will ever appear have been formed several months before birth. Many of the cells of the cortex have only begun to develop branches that connect with near-by nerves and have developed but few of the longer fibers that connect one part of the cortex with other parts and with the lower brain and the cord. The medullary sheaths have not formed on those nerve fibers that already extend to other parts of the brain, which is a significant fact when we remember that these sheaths act as insulators, making it possible for nerve impulses to travel a nerve without being quickly diffused through contacts with other nerves. Nerve paths to the lower brain and thence the relays of other nerves back to the sense organs have developed their sheaths in the last months of embryonic life—first, those of touch, pressure, and tension from the skin, muscles, tendons, and joints, and those that are concerned with taste and smell; later those of sight, and then those of hearing. It is in the cortex that development is most delayed, and it is on this development that consciousness waits. The organization and control of intelligent behavior center in the cortex, and consciousness develops as these cerebral areas mature and are brought to a functional state.

A gross picture of this brain development may be had from noting the increase in the weight of the brain. The average weight of the brain at birth is approximately 350 grams and at maturity (twenty years of age) approxi-

mately 1,350 grams. As the graph below shows, one-fourth of this growth has taken place before birth, the next fourth in the first 6 months after birth, and the third fourth in the following 2 years; as for the last fourth, one-half of it may be assigned to the period between two and one-half and seven years, and most of the remaining growth takes place before the age of fourteen.[1]



Growth of Brain.

Increase in weight of brain from birth (350 grams) to 20 years of age (1350 grams).

When it is remembered that the full quota of nerve cells was formed before birth, the rapid development of brain weight in the early months of life appears to be due to the maturation of connecting fibers and the development of the sheaths that insulate the nerve pathways. In a word, this means more and better connections, and more and better connections open the way for increased complexity of behavior under the control of the higher centers of the brain. This increased complexity is accompanied by the

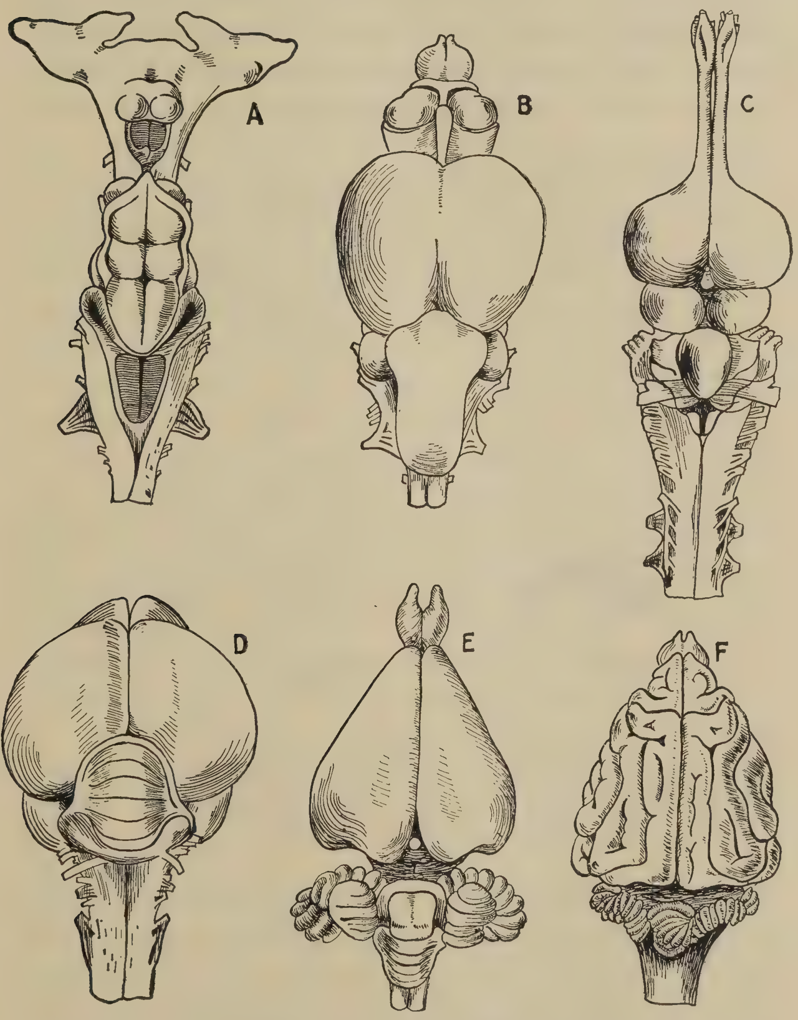
[1] Bühler, Karl, *Mental Development of the Child,* pp. 33–42, Harcourt, Brace & Company, 1930.

development of consciousness; the babe knows more of what he is about, learns more, and becomes able to learn still more.

Brain and Consciousness in the Animal Series.—Another gross picture that leads to an understanding of developing consciousness is presented in a comparison of the brain structure of man with that of other organisms in the animal series. Man stands at the top of the animal series, differing from other animals in no respect more markedly than in his capacity to learn and the consciousness that accompanies his higher orders of behavior. In keeping with these differences, we find in man a great increase in the size of the cerebrum as compared with lower brain areas and in the number of convolutions which increase the area of the cortex. In the diagram on the next page, the proportions of old-brain and new-brain of several animals on different levels of the biological series are shown. The increased proportion of new-brain to old-brain as the series ascends is apparent, as is the increase in area of the cortex that is made possible through the greater folding and fissuring of the outer surfaces, which is seen particularly in the brain of man, shown on page 172. A survey of the behavior of the animals in the ascending scale shows less and less of restriction to basic patterns and limited environment and more and more of intelligent adaptation that involves conscious and purposeful control of environment.

From the Activity of the New-brain Areas Arise the Higher Levels of Consciousness.—The evidence found in the development of the brain as the babe grows older points in the same direction as that indicated by changes in the brain of animals at different levels of the animal series. There is little question that the higher levels of conscious behavior await the development of the higher brain areas. The cortex in man is spread over deeply convoluted fissures to gain surface, and the internal structure of the cortex has a high degree of complexity in the differentiation of cells that increase the possibility of diversified patterns.

The complexity of pattern in a given area of the cortex is multiplied a thousandfold through the interconnection

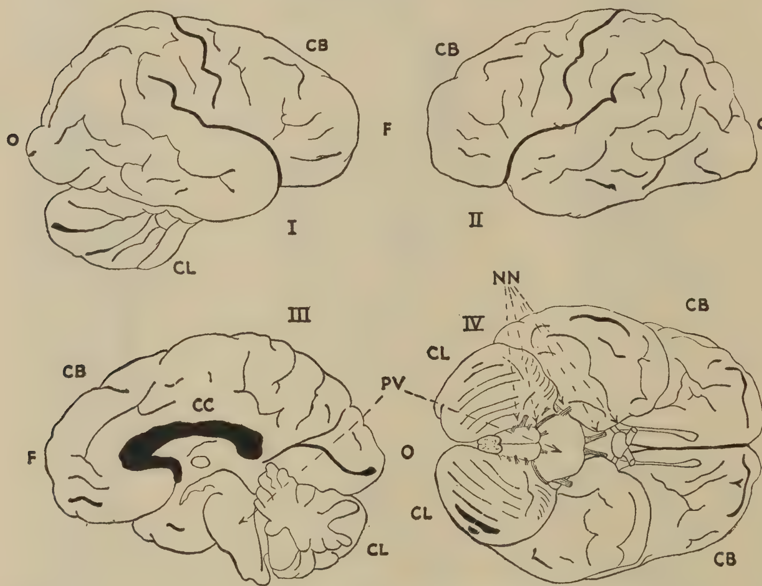


BRAIN IN THE ANIMAL SERIES.

A, dogfish; *B*, salmon; *C*, alligator; *D*, pigeon; *E*, rabbit; *F*, dog. (*From P. H. Mitchell, Textbook of General Physiology, after Wiedersheim.*)

with other areas that lie near by and in more distant regions. Some of these areas of the brain, instead of being specifically

related to certain sense organs or muscles, function as switchboards or association centers through which the activity of many cortical areas may be unified and brought into a single pattern for the control of new behavior. The mass of the cerebrum below the cortex consists of lines of communication capable of bringing unity out of diversity.



Four Views of the Human Brain.

I, from the right side; II, from the left, side; III, middle view; IV, view from below. *F*, frontal portion; *O*, occipital region; *CB*, cerebrum; *CL*, cerebellum; *NN*, nerves; *PV*, pons Varolii. (*From Franz and Gordon, Psychology.*)

The lines of communication are not in condition to function at birth; the rapid increase in brain weight during the first few months after birth is due in great part to the growth of these connecting fibers but more particularly to the development of the sheaths that make it possible for nerves to function independently. As development proceeds, the cortex becomes thoroughly interconnected, one part with another. Branching fibers of cells in every part of the cortex connect with near-by cells, other fibers run to adjoining

areas, and still longer fibers join in trunk lines to reach more distant areas. Great bands of nerves connect one hemisphere of the brain with the other, and great peduncles, or stems, connect the cerebrum with the lower brain areas.

Here is indeed a diversified organization, but with the parts so interrelated that unity and diversity are not antagonistic. Through this organization of neural tissues flow continuous but varying streams of nerve impulse. From a great variety of sense organs that make contact with the outside world there come streams of excitation, and other streams flow outward to the muscles of the body. In the early behavior of the infant we see the result of the unorganized state of the cortical areas and of the cerebral connecting system. The higher brain areas must be developed to make possible the selective activity that is necessary for orderly behavior on the higher and more complex levels. Some patterns of behavior are organized, however, even at this early stage of development, and from these organizations there undoubtedly arise levels of awareness and lower orders of experience that may possibly be called consciousness.

Brain Development Leads to Changed Behavior.—The changes in old-brain and new-brain organizations may seem far removed from the changes in the observable behavior of the growing infant and child, but it is to these areas that control of all behavior is ultimately referred. The body needs for nourishment in the first week of life cause upsets in the flow of neural energy in the old-brain that result in the squawls and screams which we interpret as hunger. Simple reflex responses to the prick of a pin may be organized in the cord, but the more complex responses to the pinprick or to a loud noise are organized in the lower brain areas. Gradually, the patterns include more and more of the cerebral areas as these develop. Gradually, the responses take on more definite character; they become more intelligible as the whole behavior of the infant becomes organized more definitely in relation to particular things and people seen and

heard. As the crying, helpless infant develops into a talking, self-reliant child, the neural patterns that control his behavior represent a union of the new-brain, which is concerned dominantly with the learned contacts with the outer world, and the old-brain, which is concerned dominantly with the maintenance of the inner organization of body functions.

The behavior at a given time becomes dominated by the impulses from one or more sources; from the eyes come impulses set up by the stimuli of bright lights or jam; a loud noise or a familiar voice becomes the source of stimulation of impulses; perhaps the impulses may come from the organs of taste or smell, of touch or pressure or pain, or of balance, or from the motor centers that are aroused by body movements such as are occasioned by falling. All these combine in patterned form, pitched as it were in different keys and in different tempo according to the circumstances of both the outer and inner life.

In the next chapter further attention will be given to the interpretation of the activity of the brain. For the present, we may content ourselves with the more general picture of varying states of rest and activity, of varying degrees of pattern and organization according to the circumstances of the environment and the inner organizations that are the product of growth and learning. The changing circumstances from without vary continuously, and the equilibrium and the state of activity within are continuously changing. One basic principle may be observed in all this activity; from a state of stress the organism always tends toward a state of stable equilibrium. If the baby is in an uncomfortable position, he moves about until he becomes more comfortable, he ceases his complaining as he becomes more comfortable, he ceases his crying when he has satisfied his hunger—in general, human beings cease their striving when they attain their goals. About us on every hand, we observe behavior that gives evidence of this continuous drama of issues raised and the reestablishment of equili-

brium through the organization of neural patterns of the brain that control behavior and adjust man to his environment.

Summary: Developing Consciousness Accompanies Developing Intelligence.—Our study of the development of intelligent behavior and of consciousness has been approached in several ways, all of them pointing to the general truth that consciousness is a natural accompaniment of the complexity of the patterns of the higher orders of behavior. Let us summarize the evidence from various approaches that leads us to think of conscious life as a natural manifestation of the highly intelligent types of behavior.

In sleep the autonomic activities continue; the higher levels of behavior are unorganized, are at rest. In dozing and in daydreaming, behavior is not highly organized; it is lacking in continuity and purpose. We are awake and more or less aware of the world about us, but we are not fully conscious of what we are about. When we are fully awake and going about the day's business of living, we find our behavior organized and orderly; it has continuity, it has a higher order of purpose, we know what we are about. Then at times, consciousness rises to states of still greater alertness and vividness. We experience many levels of consciousness in the course of everyday affairs. The higher levels of consciousness are revealed as the natural accompaniment of the organization of higher orders of behavior.

The relation of conscious states to the organization of higher orders of behavior is revealed in the early development of the infant. Evidences of developing consciousness are found in developing ability to attend, that is, in ability to persist in the activity of new patterns of behavior. Random movements become organized movements with continuity and purpose, and facial expression reveals the beginning of conscious development. New patterns are organized as the eyes and ears and hands are coordinated in such activities as watching moving fingers or moving a rattle to hear it make a noise; with these new developments

come the evidences of attention and higher levels of consciousness.

The relation between developing conscious states and organization of higher orders of behavior is further evidenced by the changes that take place in the nervous system, particularly in the cerebrum. There can be no doubt that the higher levels of conscious experience of adult life are dependent upon the neural activity of the cortex of the cerebrum. The development of the connecting systems of the cerebrum, which bring into play the millions of nerve cells of the cortex, takes place in the early period of life when the child is rapidly developing new patterns of behavior and when attention and new purpose are increasingly in evidence.

Thus we have before us the three aspects of life: the outward behavior which we may observe, the inner awareness or consciousness of what we are about, and the neural organization through which new patterns and new levels of consciousness become possible. These are three ways of viewing the development of the child from basic behavior to increasingly intelligent behavior. The development of the higher brain centers of the individual is accompanied by higher levels of consciousness and an increased complexity of behavior which give the organism more intelligent control over environment.

SUGGESTIONS FOR NOTEBOOK AND BULLETIN BOARD

1. Assemble a short series of illustrations that show the whole-to-part development of behavior patterns. Examples are on every hand. Babes start to walk with the whole body involved in the pattern, and in a few months walking has been delegated to the legs; at first they reach for objects with the whole body but in a few months with only those actions that are necessary.
2. Select and organize materials to show the range of behavior patterns which appear as the human infant develops into childhood. These should include examples of patterns that: (*a*) are ready to function at birth; (*b*) mature soon after birth; (*c*) will unquestionably develop in the course of early years, such

as walking and talking; (*d*) are examples of the ability of human beings to make adaptations to a wide range of novel situations that are not definitely anticipated in the basic behavior patterns.

3. *Play* is our everyday name for a wide variety of activities through which nature matures patterns of behavior. The patterns may have arisen either through growth or learning or through both. Organize a series of illustrations to show play at different stages in life, from the babe playing at the game of watching his own fingers move, to the aged playing checkers. You may wish to organize the series in two divisions, putting on one side of the page illustrations of play activities that result in the maturation of patterns arising from growth, and on the other side of the page patterns arising from learning.
4. Levels of conscious experience parallel in general the levels of intelligence, which in turn parallel the increase in complexity of behavior patterns. In adjoining columns organize illustrations that show these developments: (*a*) in the advancing series from lower organisms to man; (*b*) in human development from the embryo to mature man; (*c*) in the variations of adult life from sound sleep to vivid conscious experience. These suggestions may well be developed by several students working together, with the material then organized on a bulletin board to make an effective display.

DIARY OF YOUR OBSERVATIONS

Many of your observations may parallel the suggestions given for the development of your notebook.

1. If possible, observe a child at intervals during the first month after birth to note the beginning of the changes from a sleeping and negatively behaving organism to the more wakeful and positively behaving infant. Perhaps the observations of the class can be pooled so that firsthand reports of observations of children of various ages may be pieced together to give a picture of this early development.
2. Record instances from your own experience in which reflexes are found to be inadequate to take care of situations that are too complex, such, for example, as when a cinder gets into the eye. Do you find other reflexes, like rubbing the eye, coming to the aid of the first ineffectual reflex response?

SUGGESTED READING

1. Bühler, Charlotte, *First Year of Life* (The John Day Company, Inc., 1930) contains many descriptions of the behavior of infants, some of which you will wish to read. A good selection is the record on pages 94 to 101 of about 7 hours of activity of the babe Case B45. Most of this time B45 is engaged in spontaneous playful activity.
2. An interesting portrayal of the babe's adjustment to new life at birth is to be found in Goodenough, Florence L., *Developmental Psychology*, Chap. 7, pp. 126–130, (D. Appleton-Century Company, Inc., 1934). Note also the section on "The Behavior of the Newborn," pages 130 to 142.
3. Selections from various authors on the development of the nervous system are found in Robinson, E. S., and F. R. Robinson, *Readings in General Psychology*, Chap. 3, pp. 60–95, (University of Chicago Press, 1923). A cursory perusal of these selections or even a survey of the illustrations will be desirable if limitations of time do not permit more careful reading.
4. The neural pattern controlling an intelligent pattern of behavior is inconceivably complex. Herrick, J., *Neurological Foundations of Animal Behavior*, pp. 245 *ff.*, (Henry Holt & Company, Inc., 1924), has summarized some of the determining factors that influence such patterns in the making.

Chapter Eight

Organization in Learning and in Conscious Experience

As was pointed out in the previous chapter, the intelligent adaptations made by human beings play an increasingly important role in the life of the developing child. Casual observation of the life about us reveals a world of human activity, much of which has been organized through learning; current life and past achievement place the process of learning in an important position in the scheme of world affairs. Not only does life in the large present a world of things to be learned, but learning holds a dominant place in the life of growing children. During the early weeks of a babe's life growth holds the center of the stage, and it continues to be an important factor in development; but very soon the intellectual capacities of the youngster develop, and he is on the road to a lifetime of endeavor in which learning is highly prized both by the child and by the adults who observe his development. We learn and are presently faced with the need for learning more; and the more we learn, the more we are able to learn.

Approaches to the Study of Learning.—Throughout the preceding chapters there has been an adherence to a certain point of view on, or method of approach to, the study of human behavior. This point of view tries to study life on the move; it regards human behavior as the interaction between the human organism and its environment. From this

approach, neither organism nor environment can be looked upon as fixed. The human organism changes, what it is able to do changes, and the outside world to which human beings adapt also changes as far as it enters into the life of the changing human being. In early chapters, growth and maturation have been interpreted in this manner, and the same approach is suitable for the study of the learning processes. In the further study of learning, we shall still wish to hold to the idea that we are concerned with developing human beings, who are forever changing in their natures as they change in their relations to their environment. As far as it is concerned with changing organisms, the outside world will be thought of as changing in its relation to the learning individual; the world of the boy or girl of seven years is different from the world of a three-year-old child, however much it may appear to adults to be the same old world. As might be expected from our previous study, learning proves to be a matter of organizing and reorganizing the whole of the life of the individual; the particulars of human behavior are always what they are because of the part they play in the larger whole of development of a particular individual.

The choice of a method of approach to learning is of considerable importance, and it is well to be aware that other modes of approach are employed. For example, it is only too common to see parents and teachers so preoccupied with what is to be learned that they show little understanding of or sympathy with the learner. It is natural that adults should be preoccupied with the finished products of learning rather than with the process. While we are learning, we are expectant of what we may learn and are not greatly concerned about how we learn. Thus adults tend to think of what is learned as fixed and of learning not as a progressive change in the learner but as something being accomplished or made fixed. One should be wary of the influence that such a point of view may have upon one's understanding of learning, which, after all, is a process of adaptation and should be studied as such.

Another approach to the study of learning, quite the opposite of that just noted, puts too great emphasis on the change in the learner with too little concern for the direction and purpose of the learning. Such a point of view is illustrated by parents and teachers who believe that as long as a child is actively engaged there need be little concern with what may be the practical results of his learning. Learning from this point of view is looked upon as a developing capacity quite as self-regulated as the processes of growth and maturation. The fact remains, however, that life at all stages is a continuous process of adaptation between the individual and his environment. In this changing drama the direction and purpose of the child's learning is quite as important as his increasing capacity to learn; his intelligence does develop, but at the same time he progresses in the organization of his understanding of the outer circumstances of his life. He learns, and thereby develops his ability to learn more; but at the same time the learner becomes organized to meet similar situations more readily in the future. Through this increased understanding, he gains in certainty and stability, thus justifying, in part at least, the point of view of those adults who seem too conscious of what is to be learned. It is to be hoped that through our study we may develop an interpretation of learning which will resolve the apparent conflict in these points of view. If we interpret learning as a progressive organization of human behavior to meet the new in the environment, it should be possible to gain an insight and understanding which will recognize the change taking place in the learner and the purpose that makes the change of significance.

Unity of the Sensory and Motor in Learning.—One error that may arise when adults read their own experience into that of developing children comes from the fact that we are so conscious of the particular avenues of sensory contact with the outside world that we have made artificial pigeonholes for what we have learned. Thus we think of things having been learned by seeing, hearing, touching,

tasting, and smelling, and then on consideration we decide that there had better be at least another pigeonhole—one for learning by doing. After brief consideration it should be clear that the sensory and motor are not separated in experience. It is difficult to think of a thing learned by doing that is not at the same time learned by seeing, hearing, touching or through some other sensory channel. If we look at it the other way about, we see that we cannot learn through the senses independently of learning by doing and

(*Courtesy of Los Angeles Public Schools.*)

Is it Doing, Alone, That Makes Such Experience Valuable?

that both sensory and motor aspects are dependent upon the purposes which dominate our behavior at a particular time. Suppose, for example, that a sound comes from behind us. Whether we pay attention to the sound depends upon circumstances, on whether we are set for the sound or intently set for another incident such as the untangling of an automobile accident ahead of us. Let us note what happens if we do attend to the sound. The body turns about; the head is lifted the better to receive the sound. Relative

intensity of the sound in the two ears has given the cue for the turning of the body and the directing of it so that we face squarely the source of the sound. The eyes are moved to bring the source of the sound more directly into the line of vision. They are angled one to the other according to the distance; the muscles of accommodation move to shape the lenses to clarify the image; and the pupillary reflexes have already adjusted to the new light conditions. Why should this be called either a sensory or a motor experience? All this muscular activity has been guided by sensory data, and in turn the sensory organs have been able to function only through the cooperation of muscular activity.

The unity of the sensory and motor aspects of experience becomes very pointed as we study the function of kinesthetic nerve endings. These sensory endings, which receive the stimuli of contracting muscles, stretching tendons, and pressing joints, work in close coordination with stimuli set up by variations in the pressure of the liquid in the semicircular canals of the inner ears. When we turn to listen to a sound, the very first movements of the muscles stimulate these nerve endings and set up sensory nerve impulses that unite with the impulses from the eyes and ears and other sense organs, so that several types of sensory data combine to form the streams of neural energy which are united in the brain. This stream of incoming impulses is organized in the brain and then proceeds outward over motor-nerve tracts to control muscular activity. The patterning of such a flow of neural impulses was once developed to control our movements when we learned to walk. In this learning, the excitations arising from the semicircular canals, stimulated by change in posture, from the eyes, from pressure in joints in feet and legs, from tensions in tendons and muscles—all entered the central areas of brain and cord and there became organized into a controlled pattern of nerve impulses leading back to muscles. We find children making sport with these organized neural streams by whirling themselves about till they are dizzy and stagger as they try to walk. In

so doing they disrupt the customary pattern; the sensory excitations from things seen and from body posture are put into a disorganized state by the excitations coming from the semicircular canals which have been muddled by the whirling. We may find the same patterns in confusion when we arise in the dark at night, the cues from the eyes not being available in the dark and those from the semicircular canals not yet being adjusted because of the sudden rising from a reclining position. We have examples of some of the kinesthetic impulses organized into patterns with other sensory and motor impulses in such habitual activities as tying of shoes and neckties and the brushing of teeth and hair. In all these examples the motor and the sensory are so unified in the activity that it is quite beside the point to say that they are either sensory or motor. Indeed, it is to the controlling influence of the pattern formed in the brain that we would look if we were to designate any one part of the whole as crucial. This complex brain pattern can be labeled neither sensory nor motor.

Mirror Drawing.—It is well to appreciate through some firsthand experience what it means to learn something that is largely new. Mirror drawing provides such an experience, and the reader is urged to enter into the following experiment. Prepare several sheets of paper, on each of which you draw two squares, one within the other. Make the larger square with sides 4 inches long and the smaller square with 3-inch sides, leaving an alley ½ inch wide between the sides of the two squares. Place one of the sheets of paper with the squares on it before you on the table; put a screen or pile of books between you and the paper so that you cannot see the squares directly. On the far side of the paper, place a mirror angled so that the squares appear in it as you look over the screen. Reach around the books or screen, place the point of your pencil at any point between the two lines, and proceed to draw a line through the alley as seen in the mirror, keeping between the lines that form the sides of the two squares if possible. After the first trial, repeat

the performance several times with new sheets of paper until you have gained some facility in completing the circuit.

This mirror-drawing experiment is prescribed for parents and teachers who are impatient with young learners. It takes one back to the fumbling experience of learning to tie one's shoes. For our present purpose the mirror drawing serves to bring vividly before us the reality of the unity of the sensory and the motor in learning, and it emphasizes the more significant fact that the patterning and coordinating of the new behavior takes place in the brain.

Organization of Old and New Experience.—To the mirror drawing one brings much that has already been learned, much that is already organized. For example, one is able to sit at the table and hold the pencil; one understands how to reach around the books and where to look to see the image in the mirror. These and many other parts of the experience are an old story to us and receive little or no attention. The many old parts, however, cannot hide the fact that this experience requires a new organization. One of the most interesting aspects of the experiment is the new orientation to the total situation that must be worked out. At first we seem to be asking ourselves, "How does one get at this job anyway?" We may have difficulties that are strangely mixed because of seeing the task from changing points of view, at one time based on how we know the task would appear if seen directly without the mirror and then on how it actually appears in the mirror before us. The whole experiment may be different according to the way in which one places the pencil at the start. Our experience may be one thing if we look over the books and place the pencil while we are looking at the alley directly, and it may be quite another thing if the pencil is first placed by looking into the mirror. Such differences in beginning give different sets to the whole task; we may proceed with the experiment in quite different ways because of the way we are oriented to the problem.

To some degree, we are conscious of this problem of orientation as we proceed with the drawing. We are aware to greater or less degree that we are in search of ways of proceeding which will make our efforts more fruitful. We are sensitive to our successes and failures as new phases of the problem arise. The first attempts at turning the corners may quite upset the development of a pattern that has been effective as long as we proceeded in the same direction along one side of the square. In such circumstances we are very close to the problem of learning; we are conscious of its purposeful nature, conscious that the direction of our efforts is significant, and conscious that we are organizing our present experience as the basis for more successful adjustment to which we look forward.

This simple mirror-drawing experiment brings before us in a firsthand manner several important aspects of the process of learning, each of which becomes a center for careful consideration. (1) The newness of this experience may well raise the question of how wholly new presentations of the senses became organized in our early life so that they had meaning. (2) There is the problem of how our experience becomes organized so that it stays with us to make further learning easier and more effective. (3) There is the problem of how we are able to know that we are working in the right direction as our learning proceeds, which, in other words, is the question of how we keep oriented to our problems. The first of these problems is our concern in the remainder of this chapter, and in chapters following the other two problems will be considered.

"What's-that" Situations.—We find an experience like the mirror drawing interesting because it is novel. Most of adult life is so loaded with the old organizations of experience that it is difficult to realize what a new sensory experience of a child might be like. It is essential to the understanding of learning that one appreciate the nature of new conscious experience that arises from early sensory contacts with the outside world; we should have some

understanding of how the raw data of the senses become organized, how they come to mean something in our conscious life. In gaining this understanding the basis will be laid for considering later how new experience becomes old experience, that is, how it in turn becomes organized to become a part of more experience.

How do the raw sensory data from the outside world become patterned and begin to mean something before previous experience has supplied a basis for its interpretation? Bühler[1] gives an account of such an early experience drawn from her observations of a babe who in the second and third months of his life is found intently staring at a dark spot on the wall. This intentness can hardly accompany thoughtful reflection because he is too young and inexperienced to make this possible. Some might say that such staring is of the nature of a reflex, but this behavior is too continuous to be classed as a reflex. His behavior is such as to make one believe that the child is becoming definitely aware of something. From his expression, one might decide that his inner experience may well be called a "what's-that" experience. If the stimulus were strong or extreme, he might cry, and if it were a smiling face, he might smile in return; but there is a new persistence and a new intentness in this behavior. For days the spot has been there within the range of his vision, a part no doubt of the background of things that he has seen in the random use of his eyes, probably a part of the neutral undefined ground against which human faces have been more clearly set. Now it seems that the spot has emerged from the background and taken form. This sensory presentation is probably ill defined, it is true, and it probably arouses a conscious experience that is not at all like that which adults have in looking at the same spot. The baby may have had no previous experience with this spot or with anything like it; but it is there now for the first time, ill defined and ill patterned as an experience,

[1] Bühler, Charlotte, *The First Year of Life*, pp. 45 *ff.*, The John Day Company, Inc., 1930.

but nonetheless an experience that has the characteristic attentiveness of meaningful consciousness.

This experience probably brings a very meager beginning of meaning; but there is reason to believe that there are in it the elements of recognized form, and to this extent at least it has meaning. As the days pass, the babe is found gazing at the spot again and again, gazing intently and with pleasure. This persistent returning to a new experience is characteristic of maturation of new patterns. Such repeated returning to a new experience is to be seen at a later period in the baby's life when he watches his moving fingers or when he exercises his new-found vocal achievements in what we call babbling. Noting these repeated returns to such gazing, we feel warranted in assuming that the new pattern is taking on more definite form. His experience means more to him; it changes from the "what's-that" character by taking on a "there-it-is-again" quality. New meaning is added to old, but both new and old, we may be sure, are very meager at this early stage of development.

Dominance in the Organization of Conscious Experience. As the babe stares at the dark spot on the wall or at his moving fingers, what is the nature of the changes taking place? As he holds his moving fingers before him, he seems to be experimenting. We might say that he is attempting to discover heads and tails of this business of moving fingers. Is he seeing first one finger, then another as it moves, then perhaps other parts of the hand or arm; or is this intent business concerned first with what he sees and then with what he feels as the fingers move? A reasonable interpretation, or let us call it a reasonable hypothesis, is that this is essentially a process of organization which has two phases. The first phase is the emergence of the presentation of the thing seen from a neutral background, and the second phase is the reorganization of the whole experience as parts of the experience become dominant over other parts.

There can be little doubt that this experience is set against a background of undifferentiated sensory presenta-

tions arising from many sources. This background arises from stimuli from the contact of clothes the child wears, from the bed upon which he lies, from noises about him, from random movements of legs, perhaps, from those indefinable impulses that adults interpret as hunger or fatigue or well-being, and from many other excitations of nerves that arise at all times in the course of body changes. The experience of the moving fingers, like the staring at the dark spot on the wall, is set off against a mass of undifferentiated experience. The intentness and the continuity of the gazing at the spot on the wall, or the way in which the fingers move under control rather than in the usual random manner, warrant the inference that the total experience is organized, and organized with that part of the total concerned with the dark spot or with the fingers dominant over other parts. This reorganization may come perhaps with the successive observing of one finger and then another as it moves, perhaps with the feel of the moving fingers becoming dominant over seeing them move. It makes little difference in regard to the principle involved whether this differentiation of parts from whole is accomplished by setting the consciousness of one finger against that of the other, or by setting the moving of fingers against the seeing of fingers. The point of this interpretation is that these early experiences take form out of and against an undifferentiated background, with dominant parts differentiated so that the total conscious experience is more definitely organized.

The babe's experience at a given time may be described as consisting of a total of undifferentiated background against which is set the more definitely patterned and more definitely conscious experience of moving fingers. But the pattern and the conscious experience change continuously, and intentness on the fingers seen now may give way to intentness on a moving thumb, or intentness on feeling fingers move may give way to seeing them move. Then, as time goes on, the whole pattern may change, displaced per-

haps by the demands of hunger, the appearance of a familiar face, the sound of a loud noise, or discomfort due to his clothing. With such changing circumstances the dominant experience of the moving hand recedes and becomes a part of the background as a new phase of experience takes the center of the stage.

Sensory Presentations in Childhood Experience.—The foregoing interpretation of sensory presentations of early life needs verification by more than our observation of infant behavior. Further evidence of these basic aspects of sensory presentation is to be found in the later development of the child when it is possible to interpret his experience more accurately through his more or less intelligible vocal expression, as well as through his more mature facial expression or through sign language such as pointing. Throughout early childhood, we find children giving repeated expression to the "what's-that" phase of conscious experience as they meet the many new things of their expanding lives. When a child sees a horse for the first time, he may, by facial expression, by pointing, by the single word "look," or by some other sound meaning the same thing, give evidence of a new presentation that is accompanied with limited meaning. What is seen may be quickly interpreted in terms of other experience. For example, a child who has become acquainted with dogs may, on seeing a horse for the first time, call it a "big dog." In many cases, we may find the new experience stimulating a veritable shower of questions which give evidence of the development of new meaning. The shifting attention to first one particular and then another is evidenced by his queries of "What's this?" and "What's that?" In these experiences of child life we find verification of the two aspects of sensory presentation: (1) The newly experienced objective world takes form out of and against undifferentiated experience accompanied at first by only the rudiments of conscious meaning. (2) These initial presentations are reorganized as parts of the larger whole emerge into the foreground of conscious-

ness. With these changes in the parts that are dominant there is of course a change in the larger whole. For example, the head of the horse on which the child is intent at the moment is not just a head, but the head of the whole horse of which he was much aware only a moment ago. His new understanding of the horse, arising perhaps from the horse raising and lowering his head in eating, may not only change his understanding of the horse but also modify his whole orientation to the business of finding out about horses. Such, indeed, seems to be the nature of learning; it follows the principles that govern all differentiations of behavior in which parts emerge from the less differentiated whole. With all their newness and independence, the parts remain in relation to the whole and change the total organization.

Sensory Presentations in Adult Experience.—With their rich past experience, adults interpret the successions of life situations so quickly that they are generally not aware of this initial query state. There are times, however, when adults may become aware of "what's-that" situations. For example, there was the time when, on a winter's night, you were driving home and there ahead outlined against the snow you could see "something." It took form but had no definite meaning. As you continued to observe it, the "something" appeared different, it began to mean something more definite, and presently you recognized it to be a washed-out place in the road that had not been fully covered by the snow. Other examples might be cited, such as sounds heard that produced at first only the initial query state, followed some moments later by a definite patterning of the experience with meaning flashing upon you. Who has not reached into his pocket or perhaps to the stand at the side of the bed at night, to find something strange and unrecognized, but nevertheless "something." The first phases of such experiences arise from little but raw sensory experience with meager meaning attached. Then, out of this first phase, attention shifts from one phase to another, the total pattern

takes more definite form, and the fuller meaning and significance of the situation burst on one.

Thus, from our observations of babies and children and out of our own experience as adults is drawn the picture of the two basic phases of sensory presentations. In the next few pages is assembled experimental evidence that will give further understanding and verification of these basic processes.

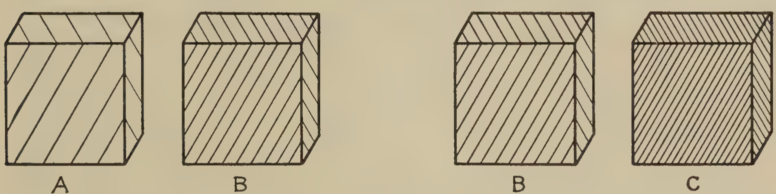
Experimental Evidence Concerning Sensory Presentations.—Children of three cannot tell us the nature of their conscious experience, nor can chimpanzees, chickens, or goldfish. We may, however, control the circumstances of their behavior so that we may learn something about the most primitive form of sensory presentations in these widely different organisms. In so doing we come to see these processes as basic to all learning.

Köhler[1] placed two boxes before a child of three years of age, one of which was of a brighter shade of gray than the other. With the child observing him, he placed candy in the box of the darker shade. The child found the candy, and after a few repetitions of the game he always went to the darker of the two boxes for the candy even though he had not seen it placed in the box. The boxes during this part of the experiment had been moved about so that their position would not be the basis for the child finding the candy. When this preliminary part of the experiment was completed, the stage was set for determining how these boxes appeared to the child. A third box, darker in shade than the one in which the candy had been placed, was substituted for the box of lighter shade, so that of the two boxes before the child the one that had been the candy box was then the lighter in shade. To which box did the child go for the candy? He went to the new box, the darker of the two, rather than to the one in which he had always found the candy. It appeared that the candy box was not identified as the "one-with-a-

[1] Reported by Koffka, K., *Growth of the Mind*, pp. 156 *ff.*, Harcourt, Brace and Company, 1928.

certain-shade-of-gray," but rather as the "darker-of-the-two-boxes." Within the sensory presentations as a whole the two boxes had been seen in relation, not separately; the child had learned to select the darker of the boxes.

Chimpanzees Make Relational Choices.—Köhler[1] tried much the same experiment upon chimpanzees, using first boxes of different sizes, then boxes of different shades of color. Much the same results were obtained with chimpanzees as with the child; they, like the child, saw the whole situation, and their choice of boxes was made on the basis of the relative size or relative intensity of color, rather than on the basis of how a particular box looked by itself. In this



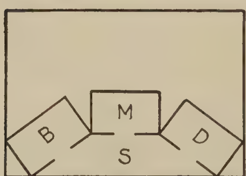
With boxes *A* and *B* before him, a child learns to get candy from *B*. With only *B* and *C* before him, will he go to *B* for the candy?

experiment, as in that with the child, the boxes had been moved about and interchanged in position so that their location could not be the basis for the choice.

Hens Make Relational and Differentiated Choices.—Köhler experimented with hens, also, placing grain on two different shades of gray paper, permitting the hens to eat the grain from one of the papers and chasing them away when they went to the other paper. Two of the hens he taught to go to the lighter of the two papers, and two others he taught to go to the darker of the two papers. Then, when the learning was completed, he substituted still lighter shades for the first two hens and still darker shades for the other two hens. As in the experiments with the child and with the chimpanzees, the intent was to discover if learning had depended on seeing the papers in relation, that is, by choosing the lighter or the darker of the two, or whether

[1] *Ibid.*, pp. 153 *ff.*

they had "spotted" one of the shades as the one to which they were permitted to go. As in the other experiments the papers were moved about so that location was not a factor in the choices. The hens were given a total of 85 chances to make a choice after the papers were changed, and about 70 per cent of the choices were for the lighter or darker of two, while about 30 per cent of the choices seemed to be made for the particular paper from which they had learned to get grain. The greater part of the choices thus seemed to be on the basis of relations, but some seemed to be made on the basis of the specific shade of the paper.

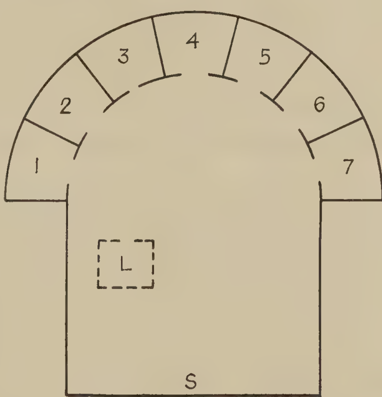


Apparatus of Goldfish Experiment.
B, *M*, and *D* are bright, medium, and dimly lighted compartments. Positions of lights are changed after each trial. (*Wheeler and Perkins.*)

Goldfish Make Relational Choices.—Wheeler and Perkins[1] in an experiment similar in many respects to those cited above, arranged three compartments in an aquarium with bright, medium, and dim lights and taught goldfish to find food in one of the compartments. Some of the goldfish were taught to go to the dim compartments, some to the medium, and some to the bright. During the learning period the light in each compartment remained at the same intensity, but the positions of the compartments were changed so that the learning could not be based on location. In the trial after the learning, the intensities of all the lights were shifted up and down so that either the middle or lowest intensity might then become the highest intensity and either the middle or highest intensity might become the lowest intensity. Thus, the goldfish that were trained in the learning period to go to the dimmest of the three compartments might in the trials after the learning have this particular intensity the highest of the three before them, or this particular intensity at another trial might be the middle intensity of the three. Similarly, the goldfish that had

[1] Wheeler, R., *The Science of Psychology*, pp. 122 *ff.*, The Thomas Y. Crowell Company, 1929.

learned to go to the brightest of the three compartments might in the trial period be presented in the three lighted compartments with what was once the brightest intensity now the middle or lowest intensity of the three. The middle intensity of the learning period to which other goldfish had learned to go might be either the brightest or the dimmest of the three lights in the trial after the learning period. Under these conditions the goldfish almost invariably made their choices on the basis of relations. Taught to choose the brightest, they chose the brightest whatever the intensities might be; taught to choose the middle intensity, they chose the middle intensity when the lights were changed; taught to choose the dimmest of the three, they chose the dimmest in the new situation. It was also found that the fish that learned to choose the dimmest light would enter a compartment with no light at all in it when it was made the dimmest of three compartments.



PLAN OF APPARATUS FOR CHICK EXPERIMENT.

Numbers 1 to 7 are lighted compartments, *L*, an extra light. Chick enters at *S*. (*After M. H. Lewis, Journal of Experimental Psychology*, 1930.)

Limits of Relational Learning in Chicks.—Lewis[1] arranged seven lights of varying intensity in a semicircle. In the first part of his experiment he did not change the position of the lights and was able to teach some of the chicks to get food from the compartment at one end of the semicircle and other chicks to choose the compartment at the other end. When the light that had been chosen was placed out of the semicircle, the chicks would almost invariably choose it, even though this choice involved making a turn

[1] Lewis, M. H., "Elemental versus Configurational Response in the Chick," *Journal of Experimental Psychology*, Vol. 13, pp. 61–75, 1930.

of the body. When a new group of chicks was used and the intensity and position of the lights were changed in the learning period, it was found that the chicks learned more rapidly, but that they learned to pick a light in relation to other lights, rather than learning to choose a light of particular intensity. It appears from these experiments that the change in the conditions of the experiment leads to a change from learning in relation to the whole to a learning in which a light of given intensity is differentiated from the whole and responded to on the basis of its intensity alone.

Some of the arrangements of the lights in this last experiment would obviously be more difficult to respond to successfully than others. Chicks learning to select the middle intensity had more difficulty than those learning to select either the lowest or the highest intensity. All arrangements of the lights for those selecting the medium intensity were brought within the ability of the chicks if the medium-intensity compartment was placed somewhere between the high- and low-intensity compartments. Variation in intensity and variation in position within these limits did not hinder them in choosing the middle intensity of the three. These experiments point, as do the others reported, to the conclusion that primitive learning is a matter of organization of the whole experience with parts in relation. Choice of compartments was made, not with reference to the specific quality of the light intensity, but to the relation of lights of high, medium, or low intensity in the compartments. The experiments as here reported indicate interesting limits in the capacity of chicks to pattern their experience. They, like human beings, find some situations too difficult to put in order.

From the experiments reviewed in the preceding pages, it appears that organisms as varied as goldfish and a young child react to situations as wholes, that is, on the basis of the relations between part and part within the total sensory presentation. Even in these simplest of learning situations, however, there is evidence that parts may become differ-

entiated to such a degree as to become the basis for the response. Differences in the conditions of the experiment may provide the factors determining whether the choices are made on the basis of relations within the larger whole, or whether a particular object has become sufficiently set apart from the whole to make it the basis for selection. Many experiments of this type have been conducted, and from them it seems reasonable to conclude that the development of new patterns of behavior begins with the relatively undifferentiated whole, which becomes organized with some parts dominant but in relation to other parts. Out of this primitive organization of experience, the learning may proceed to a point where the dominant part may become sufficiently differentiated to be recognized and responded to directly.

Experiments Verified in Common Experience.—If we turn from experimentation to everyday experience, we find plenty of examples of this process of differentiation. When one is introduced to a stranger, one first gets a general impression of the new acquaintance; then, after this general "sizing up," more and more the details of his features and posture and other peculiarities are given special attention. Often, one or more of these details becomes the dominant characteristic by which we remember the person; he becomes the person with the Roman nose, the person with the green-brown eyes, the person with the peculiar contour of the shoulders, or the person with the peculiar walk. Through such single clues we recognize our friends who may be so far down the street that we could not possibly see facial expressions and minor characteristics.

Another example of differentiation of experience is found when we enter a room full of strange people. First, we are apt to give the whole situation a sweeping survey, which results in a general impression of the situation; then, more and more of the details are brought up before us as we become aware of individuals and smaller groups. These new wholes grow out of and take meaning from the initial

experience, and in turn they change the meaning of the initial experience. In other words, we are creating new wholes of experience within a larger experience, as this person and then another is given our attention. We see the same process take place as we listen to a new musical composition. We are not concerned at first with details, taking the music as it comes, looking ahead perhaps to what may be expected in the development of the theme; but later we find ourselves thinking of particular motifs and melodies as being the most pleasing or as being unusual. Here, again, parts emerge from the larger whole, but they are differentiated from it, taking meaning with reference to it and in turn changing the meaning of the larger whole of which they are a part.

The patterning of experience as wholes and the process of differentiation of dominant parts within wholes to make new wholes—these are of prime importance in our understanding of learning. The primitive patterning of sensory experience is seen as a basic process, and the segregation or differentiation of a part or a quality of some part, such as size or shade or color, is seen as the normal mode of development of the primitive pattern. As we proceed, we shall be dealing with these two processes, in one form or another, as the basic principles that lead to a fuller understanding of learning.

Sensory Presentation and Meaning.—What do we mean by meaning? We may learn much about meaning by studying the experiences of people who have been blind all their lives and are suddenly given the ability to see. Their first experience in seeing will tell us much of the relation between sensory presentations and meaning. In their initial vision of an object without any other sensory contacts two facts are apparent: (1) They are aware of something being there. (2) The thing they see does not have sufficient meaning to them so that they recognize it. From their behavior it is apparent that they are looking at the object, and when questioned they respond that they see "something," but they do not know what it is. This response, however, does

not indicate that there is no meaning whatsoever arising from seeing the "something." Quite the contrary, for the awareness of the object is evidence in itself of some meaning. Imagine the flood of meaning that comes to this person who was blind, when he contacts the object through some other sensory avenues that he has used before. Perhaps he reaches for the object and grasps it; perhaps it is brought near enough for it to be smelled; or it may be rapped against something to make a noise. Any one of these contacts will immediately reinstate the essentials of past experiences so that the object will be recognized. Any one of these avenues of sensory contact will open up to him a wealth of meaning, and what an interesting time he must have exploring his new-found visual avenue of meaning in terms of other experience. We see from this that some meaning does arise from a sensory presentation that is as new in experience as that here described. We also see how the presentations from the various senses combine to give most of our experiences their richness of meaning. What better evidence for this combined relation do we need than the universal abhorrence of becoming blind or deaf? How annoying we find the temporary loss of the sense of smell or taste due to a cold!

Common experience provides other evidence of the relation between sensory experience and meaning. Awaking from sleep or "coming back to earth" from daydreaming, we find the presentations of the senses becoming organized and meaning comes with this organization. As the presentations of the senses take definite pattern, the hazy experience of daydreaming is displaced by clear awareness, perhaps vivid consciousness, and with this patterning comes meaning. Meaning arises from the patterning; consciousness arises from the patterning; consciousness and meaning appear to be but aspects of the patterning and organizing of our experience. This interpretation is in keeping with Koffka's statement concerning the acquisition of meaning.

The acquisition of meaning is a process whereby parts of the perceptual field change their aspects whenever they are included in the activity of the moment. Either they are forced out of the "ground" and become distinct figures, or one figure is transformed into another. In either case as they become members of the activity at hand, they acquire new aspects with reference to this activity. Since every new aspect gives rise to some new activity, the process of acquiring new meaning is endless.[1]

Meaning is thus interpreted as basic to any experience. When sensory stimuli are included in the stream of experience, meaning arises. This meaning may come, even when there has been no previous experience, through a given sense; the person once blind but now seeing sees something. This something means something more as the past experience gained through other senses is brought into the present experience.

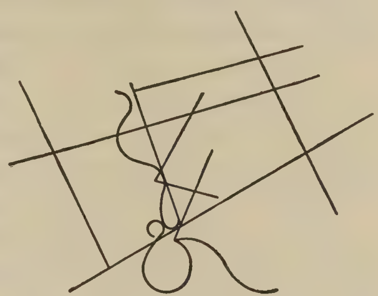
An interesting historical forerunner of the point of view concerning the meaning that accompanies original sensory presentations is to be found in a statement made by Ladd and Woodworth a good many years ago. It is quoted below. This statement does not touch on the patterning of sensory experience, but it does concede its fundamental nature. We have inserted in bracket certain words and phrases to aid in drawing the parallel between this statement and our point of view.

The direction of attention, or of analytic perception [differentiation of sensory presentations] is determined in part by dispositions left behind by past experience. . . . It is not however, entirely so determined; for certain classes of stimuli have a natural or instinctive hold on attention. Very intense stimuli compel attention, as do sudden stimuli, or moving objects in the field of view or over the skin; sharp contours in the field of vision, objects contrasting strongly with their background, have a similar attraction. These causes operate even in children, independently of previous experience, and lead to some degree of analysis [differentiation] of a presented complex of stimuli.[2]

[1] Koffka, *op. cit.*, p. 320.

[2] Ladd, G. T., and R. S. Woodworth, *Elements of Physiological Psychology*, p. 600, Charles Scribner's Sons, 1911.

The language used in the paragraph quoted above differs from that which we have chosen, but the facts described are the same. These facts are: (1) Sensory presentations may lead to awareness, consciousness, and meaning without previous experience. (2) This process leads to "some degree of analysis" or differentiation of the "presented complex of stimuli." The question we now raise is: Do not these processes found in sensory presentation underlie all learning?



One of Gottschaldt's Figures. As you look at the figure do you notice in it any familiar form? (*From W. Köhler, Gestalt Psychology, Horace Liveright*, 1929.)

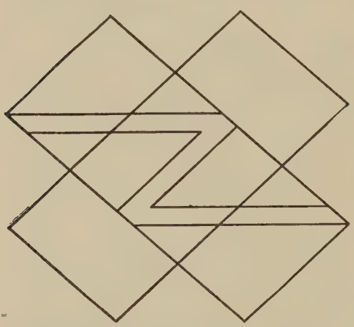
How the Past and Present Unite in Experience.—Our everyday experience gives some evidence of the fact that experience of the past has a bearing on present experience. Experimental evidence helps to reveal the way in which sensory presentations take pattern in relation to past experience. In order to give point to what follows, look at the doors about you, observing them carefully so that if you were asked to do so you would be able to describe what you have seen. Now, let us turn to the reports of some experiments.

Gottschaldt[1] asked his subjects to look at complicated designs and then report what they had seen, much as you have been asked to look at the doors about you. Some of these designs were more complicated than others, but in all of them, hidden to greater or less degree like the face of the man in the moon, were certain familiar forms. Glance at the figure above and note any familiar form in it. Once the numeral 4 is noted, it dominates the experience, but only very few people note it when they are first shown the figure and asked to tell what they see. If the reader readily observed the number 4 when first looking at the figure

[1] Köhler, W., *Gestalt Psychology*, pp. 205 *ff.*, Liveright Publishing Corporation, 1929.

above, let him now try to find familiar forms in the figure below.

You may now return to your previous experience in observing the doors. If you had been asked to describe the doors, would you have mentioned the capital I's formed by the paneling? Probably not. Now that you are disposed to look for them, you may be able to find still other forms that were previously unnoticed, such, perhaps as capital E's. Gottschaldt found that the few subjects who did discern the familiar forms within the more complex figures had shown through their questions at the beginning of the experiment that they were "set" for looking for such particulars in the general pattern. Just as it is apparent from the fact that we look at the moon many times without seeing the man in the moon, so it is apparent from the Gottschaldt experiments and from our own experiment of observing the doors that the present pattern of experience depends in part upon the nature of the presented situation, such as the door, in part upon the nature of our past experience, and in part upon the "set" or purpose of our present activity.



ANOTHER GOTTSCHALDT FIGURE. What familiar forms, if any, do you see in this figure? (*From W. Köhler, Gestalt Psychology, Horace Liveright*, 1929.)

Levels of Learning.—It appears from experiments with simple organisms such as goldfish and hens, and even with young children, that a primitive level of learning depends upon the organizing of the presentations of the senses with parts in relation to other parts. The development of such primitive patterns appears to take place through the process of differentiation, in which parts of the total pattern of sensory presentation become segregated and the total pattern becomes organized with reference to such dominant parts. Other parts are formed in the pattern with reference

to the dominant element, and in the changing activity of the organism parts that are in the background of the pattern may emerge and become the center of attention and consciousness. Meaning arises from the primitive patterning, as we see in the case of the person who was born blind and on first seeing an object knew that it was "something." The acquisition of meaning is an integral aspect of the primitive sensory presentations; it is an integral part of the changes that occur as parts become segregated and the total pattern becomes reorganized. These changes take place continuously; meaning changes for the segregated parts and for the whole experience. It is apparent that there are many levels of learning, many levels of complexity of the sensory presentation, and many levels of meaning.[1] The changes that take place are not without direction, and the meaning that arises depends upon the purpose of our present living—we see the man in the moon at one time, and he goes unnoticed at others.

Mere Repetition and the Acquisition of Meaning.—Thorndike[2] has conducted extensive experiments which furnish evidence that continued repetition of situations in experience may not lead to any significant learning. In one of the experiments he asked his subjects to "draw a line four inches long with one quick movement." They were not permitted to use any means of gauging the length of the line or to compare any one line that they drew with other attempts that they made. Day after day they returned to this task, drawing something like 150 to 200 lines a day until 3,000 lines had been drawn. What did they learn from these experiences? Were the lines nearer 4 inches in length on the last day than on the first? They were not. But more important, were the lines any less varied in length on the last day than on the first? Did the repeated experience of

[1] In subsequent chapters, meaning is treated as an aspect of all learning, as resulting from all mental processes that organize experience.

[2] Thorndike, E. L., *Human Learning*, pp. 8–15, D. Appleton-Century Company, Inc., 1931.

the subjects have the effect of making the lines more consistent in length? The answer is "no"; the experience did not provide the conditions needed for a change in the pattern that would make the lines more alike.

In another experiment, nonsense words, such as "kace-eed-aub" and "weece-ol-eet," were pronounced for the subjects to spell. In one of the three syllables of each of the words appeared the long *e* sound. The experiment centers in any difference in the way this long *e* sound is spelled at the beginning and at the end of the experiment. Sometimes it is spelled *e*, sometimes *ee*, sometimes *ie*, sometimes *ei*, sometimes *i*. Thorndike suggests that "there are subtle differences in the brains and nerves and muscles of the individual from minute to minute which cause a multiplicity or variety of responses to the same external situation."[1] The point should of course be made that the long *e* sound should be called a part of a situation, but this does not change the significance of the results of the experiment, which turned out to be that if one of the spellings is more frequent than others at the beginning of the experiment this fact does not influence subsequent spellings by making it appear more frequently later.

On the evidence of these experiments and many others like them Thorndike gives a definite "no" to the question of whether repetition alone leads to learning. "This question," he says, "is so fundamental that I have sought to check our negative answer by increasing the number of subjects and by using a wide variety of experiments in which connections of greater frequency are given an opportunity to drain off strength from those of less frequency."[2]

At the end of this extensive experimentation he concludes:

> So far as I can now see, the repetition of a situation in and of itself has no selective power. . . . The repetition of a situation may change a man as little as a message over a wire changes the wire. In and of itself, it may teach him as little as the message

[1] *Ibid.*, p. 10.

[2] *Ibid.*, p. 13.

teaches the switchboard. . . . All educational doctrines which attach value to experience or activity as such, irrespective of the direction of the experience or activity or of its consequences, are made less acceptable than before. Experience, in the sense of merely confronting and responding to the situations of life, can hardly be a powerful agent for either good or harm when several thousand repetitions of such an experience do so little.[1]

It is a common belief that mere repetition of situations does play an important part in learning, and in view of such a belief Thorndike's experiments are highly significant. The results of such experiments should definitely turn our attention to those conditions of learning situations and those aspects of experience which do play a significant part in learning. From the point of view that we have developed we are led to look for these conditions of learning in the changes that raise the pattern from a primitive level of learning to a more highly differentiated level. Thorndike's subjects remained on the same level of experience with each line drawn or word spelled. In his experiments the parts of the situations that were the crux of each experiment were not undergoing any significant changes in relation to the whole of which they were a part. In drawing the 4-inch lines and in responding to the long *e* sound the subjects had nothing in which to center their repeated attempts. What happened at one trial during these experiments was as pointless as at another trial. In Thorndike's words, there is nothing to give "direction" to the experience, nothing to bring experience into relation with "consequences."

Contiguity in Time as a Factor in Learning.—Other experiments were designed by Thorndike[2] to discover how much influence on learning would result from one experience following another. Here again he is plowing across a well-beaten path of common belief. This common belief is that just because one experience follows another they influence each other; such experiences are learned because they are

[1] *Ibid.*, pp. 14 *ff.*
[2] *Ibid.*, pp. 16–29.

together; they become "associated" in experience because they are "contiguous." A series of sentences were read to his subjects, and they were asked to listen to the reading "just attentively enough so that you can say that you have heard it and understood it." After the reading of each series of sentences, a word is pronounced and the subject is asked to name the word that followed it in the original reading. The words pronounced are those ending sentences, and the subjects, being required to name the word following, are therefore required to give the first word of the next sentence. These words, at the end and beginning of different sentences, may have little relation to each other. One follows the other in the reading, and they are heard together; but they are not significantly related in the pattern of experience. As we might expect, the number of words recalled is negligible. When the subjects are asked to name words following words within the same sentence, the number recalled is larger. Naturally, there is a great amount of variation in the recall of different words, some being significantly related to the preceding word whereas others have much less relation. The point of the whole matter is that it is relations previously established that count. Mere sequence in time has little potency in learning.

Similar results were obtained in many other situations that Thorndike devised. In each of these, the experiment centered in the influence of one part of an experience upon another part which immediately followed. The relations between parts of experience and situations Thorndike chooses to call "belongingness" and "acceptability." For example, in the experiment just described the relation between the last word of a sentence and the first word of the next sentence is weaker than the relation between two contiguous words in the same sentence—they "belong" less and are less acceptable to us. In summarizing the results of these experiments Thorndike says, "Repetition of a connection in the sense of mere sequence of things in time has very, very little power as a cause of learning. Belonging is

necessary. Even when supplemented by belongingness and acceptability it is weak and seems to need something more to help it account for learning."[1]

Experiments Verified in Common Experience.—The facts which Thorndike's experiments reveal are so commonly observed in everyday life that we may wonder at the time and energy spent on such experimentation. Justification comes from the fact that common belief, in spite of the evidence always at hand, holds that repetition and contiguity are in themselves potent factors in learning. Indeed, both these supposed factors in learning have been dignified as laws. The one concerned with repetition, strange as it may seem, bears the name of Thorndike himself. The *law of contiguity* dates back to the time of Aristotle and is known as one of the so-called *laws of association.* This law as commonly stated asserts that two things become associated in experience when they are contiguous not only in time but also in space. Of course, many things that are repeated are learned, but not because of the repetition; many things that are contiguous in time or in space or in both do become related in experience, but the crux of the relations lies in something more than mere repetition or mere occurrence together in time or space.

Let us examine a common experience to help put straight these matters of repetition and contiguity. Suppose that morning after morning a boy and girl enter their schoolroom from 1 to 5 minutes late, always entering together. Here we have repetition, and here we have contiguity of time and space. But what of it? Can the reader with these facts alone interpret the meaning of these repeated occurrences, or is there need to know more than the mere fact that two people come repeatedly into the schoolroom late? What schoolroom is this? Quite a different matter if it is a kindergarten or a third-grade or a sixth-grade or a high-school classroom. Is it a school in the country or in the city? Are the boy and girl alike in appearance, possibly being brother and sister, or do

[1] *Ibid.*, pp. 28 *ff.*

their actions suggest the possibility of their being in love? Are they of the same age or of different ages? Let us not forget also that what we are talking about is not the boy and the girl alone but the thinking that is done about them by the observer. What a difference it will make in the thinking done, in the learning that takes place, if we vary our observers! The observers may be young or old. They may have different temperaments and different "sets" or attitudes toward this business of being late, owing perhaps to differences in responsibilities in the matter. The factors of mere repetition and contiguity are but two of many factors in the experience. To be sure, there are these two factors in that outer situation, but they guarantee little or nothing of what the observer thinks. To predict what he thinks we will want to know many things about the situation represented by the boy and the girl, and we will want to know many things about the observer. With these many things in mind, we may be able to construct some notion of the interpretation an observer will place upon the incident. Suffice it to say that this interpretation will depend on more than mere repetition or mere contiguity.

The factors that count in learning are those that bring about organization in the experience. The words that follow other words in Thorndike's experiments are parts of larger wholes, and in these particular situations the whole situation is controlled, it seems, so that the experience remains on the same dead level. The larger whole is determined by the nature of the directions given to the subjects; for they are told to draw 4-inch lines with no clew as to the purpose of their activity, or they are asked to listen with just enough attention so that they can say that they have heard what has been read. Thousands of similar desultory situations and experiences are found in our lives, in which repetition and contiguity lead to little or no learning. On the other hand there are thousands of other situations in which things are experienced in relation so that learning does take place. It is apparent to the casual observer that any significant

learning may involve much that is objectively present and much that is not present, much that arises from our experiences of the past. Viewed in this manner, our problem centers in relations that are established in the course of experience. Learning takes place and meaning emerges through the changes in the relations of parts to parts, and this implies a reorganization of the whole of experience. Repetition and contiguity are in themselves mere incidents in this greater reality of relations. "Associations" may be established in the course of experience, but they are products of changing relations and not causes of these changes.

Evidence in Changed Educational Procedures.—Educational practice continuously changes, and in these changes is found an interesting and profitable record which seems to indicate an understanding that there is more than mere repetition and contiguity to learning. These changes in educational procedures are taking place in the face of the indoctrination that put a premium on a form of drill dominated by mere repetition and mere contiguity of time and space. In reading, for example, the day is long past when dependence is placed upon the repeating of *a-b*, *ab*, and the like. Once it was thought that repeating the letters of the alphabet in sequence was essential to learning to read. Now the learning of the alphabet is developed by the child using a picture dictionary as an aid to recognition of words. Though provision is made for facilitating the recognition of separate words, pains are taken to have this recognition come after the words have been learned in the relations of larger wholes of sentences. Indeed, in many of our best schools the whole matter of learning to read becomes a part of larger purposeful living, so that reading becomes of greater significance to the learner. Repetition under such circumstances is but a condition attending the maturation of new behavior patterns. Many situations are provided that elicit the persistent interest of the learner. Interest in the particular words is, under such conditions, as natural as

the babe turning again and again to the dark spot on the wall or to the wriggling fingers that he holds before his attentive gaze.

We once learned our multiplication tables, systematically beginning with the 1's, then learning the 2's, and so on, until we had learned the 12's. Some of these combinations we remembered, and some we could not remember when we needed them. Then someone discovered that certain of the combinations were easy to remember whereas some were very difficult, and the learning of tables as such was done away with, the easy combinations being taught first and the harder ones later. More recently, some of our schools are recognizing that number relations of all kinds develop out of experiences that are of vital interest to children, in other words, that the first learning of a number relation gains a wealth of meaning because of the relations it holds to the experience of the learner.[1] Such a foundation in experience gives direction to the repeated attack that the child makes upon the facilitation of his new learning.

Many other examples could be cited, showing that in the development of educational procedures we have lived and learned. Gradually, the old notions that there is potency in mere repetition and contiguity have become outlawed. The direction of this development has put an increased emphasis upon learning in relation to purposeful experience. In the succeeding chapters we shall be concerned further with the conditions under which learning takes place and particularly with the factor which Thorndike has called *direction* and *consequences*. For the present let us broaden the base of our understanding through still another approach to our problem of the patterning of new experience.

Sensory Presentations and the Nervous System.—What takes place in the nervous system in the course of such

[1] Benezet, L. P., "The Story of an Experiment," *Journal of National Education Association*, Vol. 24, No. 8, pp. 241 *ff.*, November, 1935.

Wilson, Guy M., "Teaching of Useful Arithmetic," *Journal of National Education Association*, Vol. 25, No. 3, pp. 84 *ff.*, March, 1936.

experiences as we have described? When we speak of the processes of patterning and of differentiation of parts from wholes to make new wholes, what picture is to be had of the activity of the nervous system? Let us admit again, as we had occasion to do in our study of sense organs in Chap. V, that our knowledge of these neural processes is far from complete. They are admittedly complex and difficult to study. Much study has been given to the functioning of the nervous system, however, and we are not without some knowledge on which to base at least the more general facts about it.

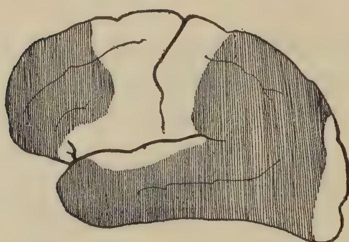
The brain is obviously the focal point of concern in such a study. Sense organs are most interesting, but they only receive the energies of the outside world and start the impulses in the nerve fibers. We must look to the brain to account for the pattern of neural activity that accompanies our complex behavior. Proof of this may be had if one will hold the hand over one eye, open a book, start to read at the top of the page, then put the hand over the other eye and continue reading with the eye that was formerly covered. If one has normal vision, it makes no difference through which eye the stimuli are received and through which nerve trunks the nerve impulses are transmitted to the brain, the reading proceeds as usual because the same cerebral organization is continuing to function. The changes that are essential to the unfolding meaning take place in the cortex, however essential the eyes may be in making them possible.

The reader might easily make himself the subject of an experiment such as that reported by Ewert.[1] Ewert found that his subjects, after learning to mirror-draw a star pattern with the right hand, could begin the drawing with the left hand with much improvement over the drawing first done by the right hand. The sensory and motor nerves of the left hand are not a necessary factor in the learning done by the right hand, but it appears that the same organization

[1] Ewert, P. H., "Bilateral Transfer in Mirror Drawing," *Pedagogical Seminary*, Vol. 33, pp. 235–249, 1926.

of neural patterns in the brain function to a considerable degree in the drawing by both hands. Perhaps the nerves and muscles of the left hand were more actively engaged than the evidence shows.

Experiments concerning the Way the Brain Functions.—Lashley[1] has done much experimentation on animals to determine the way in which the brain functions in learning. He blindfolded one eye of a white rat and taught it to select the brighter of two lights; when the lesson was thoroughly learned, he changed the blindfold to the other eye and found that the rat made the choice quite as perfectly as before. He performed an experiment of similar significance upon a monkey. By means of an operation on the brain, he paralyzed the left arm. When the lesson was thoroughly learned, he paralyzed the right arm. Later, when the left arm had recovered and the right arm had but partly recovered, the monkey was presented with the box to be opened. He first tried to use the partly recovered right arm but could not do so effectively, whereupon he immediately used the left arm to open the box.



Association Areas of the Brain. The shaded portions indicate the association areas, the light portions indicate the sensory and motor areas. (*From S. I. Franz and K. Gordon, Psychology.*)

It appears that the brain acts as a unit in effecting control and regulation of behavior. It appears also that it possesses a high degree of adaptability. There have been times in the past when much stress has been placed upon the fact that certain parts of the cortex are specialized centers concerned with the receipt of excitations from certain nerves and certain other parts are concerned with the initiation of impulses to certain muscles. Considerable areas of the

[1] Lashley, K. S., "Studies in Cerebral Function in Learning," *Psychological Review*, Vol. 31, pp. 369–376, 1924.

cortex, known as *association centers*, have remained uncharted. For many years, however, it has been recognized that even the localized areas are not fixed in their functional relations. Ladd and Woodworth refer to the work of Franz, done some years previous to Lashley's experiments, in the following terms:

> Having first taught a cat or a monkey certain specialized acts, such as getting into a cage by turning a certain button or pulling a certain string, Franz removed parts of the frontal lobes, and tested the animal to see if it retained the recently learned act. In general the act was not retained after the operation. The objection that the shock of operation, or the mere removal of a certain quantity of brain substance, no matter from what locality, was sufficient to explain the loss, was met by operations in other regions, which were not followed by loss of the learned act. Sometimes removal of part of the frontal lobe itself was not followed by such loss; and the act could be relearned after the frontal operation, the new learning taking about the same time as if the previous learning had not occurred. Habits of long standing, on the other hand, were not disturbed by such extirpations. Injury to only one frontal lobe caused, indeed, a slowing of the act, but not a loss of it. The author concludes that the frontal lobes are concerned in the acquisition of new performances of the sort used; but that no one spot is indispensable for the acquisition of a particular act; and that long continued practice in a performance reduces it to an automatic or semi-reflex condition, in which the frontal lobes are no longer necessary.[1]

The understanding of brain function at the date of the preceding quotation may be had from a further quotation from the same source.

> It is highly probable that any concrete mental performance involves, physiologically, a complex of activities of various parts of the brain; the performance as a whole therefore cannot be localized, although the elementary functions may without doubt depend upon certain peculiar nervous connections that have a

[1] Ladd and Woodworth, *op. cit.*, p. 263.

definite location. It is certain that all these mental activities involve a vast and tangled complex of simpler factors.[1]

More Recent Experimentation concerning Brain Function.—Lashley's experiments carry forward and supplement the work of Franz by putting the emphasis upon the ability of animals to relearn behavior after the extirpation of parts of the brain. Lashley[2] taught rats to run mazes and other simple performances and then cauterized parts of the cortex, varying these in location and extent. After the rats had recovered from the operation, they were able to relearn the maze running. In general, the larger the area of the cortex destroyed, the more the behavior was impaired. If the behavior was simple and learned, let us say, through vision, the learned behavior remained when any part of the cortex other than visual areas were removed. When the visual area was removed, the learned behavior disappeared, but the rats could relearn the behavior, evidently through the use of other areas whose location could not be determined. These and many other experiments have led to the conclusions that the brain, functioning as the seat of patterning of behavior, acts as a whole and that, although some parts are used more than others in the organization of a particular behavior, these parts are not indispensable since other parts may be substituted for them. Loss of parts of the brain seems to affect a behavior more through the loss in the total amount of energy than through any permanent loss of a particular function performed by the parts removed.

Cameron[3] in checking Lashley's work on localization of function taught rats more complicated behaviors and found that for these more complicated patterns there was a permanent loss when any significant portion of the cortex was removed. He concluded that it was the destruction of

[1] *Ibid*, p. 264.

[2] Lashley, K. S., *Brain Mechanisms and Intelligence*, University of Chicago Press, 1929.

[3] Cameron, N., "Cerebral Destruction in Relation to Maze Running," *Psychological Monograph*, Vol. 39, pp. 1–68, 1928.

the pattern rather than damage done to any particular localization that caused the permanent loss. It is interesting to note that much doubt has been thrown upon the specialization of particular nerve routes of the spinal cord, once supposed to function definitely in reflexes and habits. Lashley and Ball[1] show that more than one pathway is available for the particular sensory and motor impulses to and from the brain.

From this array of evidence it would seem that the organization or patterning of neural activity is a matter of great flexibility and that the ordinary problems of everyday life to which we make a conscious adaptation may involve the whole nervous system. The activity of the brain represents a continuous flow of neural energy. Naturally, some areas that are placed more conveniently than others to incoming sensory impulses or outgoing motor impulses are the routes usually taken by the main flow of energy. The flexibility of the functioning of the frontal lobes and the modifiability of other parts of the brain are in harmony with the high degree of adaptability that we observe in human behavior. In Chap. X, "Conservation of Experience," another side of this picture will be drawn.

Summary: Neural Democracy.—We profit through our experience. Learning implies that something of the pattern of behavior organized in the process of learning will be conserved. The child in Köhler's experiment established the pattern that led him unfailingly to the candy box. Patterns set up through the right eye are used by the left eye, whether they be patterns in the brains of Lashley's rats or of men. Patterns established through right arms are useful to left arms. The first building of a neural pattern in the brain facilitates its reconstruction for a similar circumstance, and, as we shall see in the following chapter, some patterns may be so organized that they are useful over a wide range of

[1] Lashley, K. S., and Josephine Ball, "Spinal Induction and Kinesthetic Sensitivity in the Maze Habit," *Journal of Comparative Psychology*, Vol. 9, pp. 71–106, 1929.

behavior. The brain is constituted for learning in new situations, and at the same time it functions under certain conditions so as to conserve essentials of patterns for use in subsequent behavior. Thus we find in learning, as we have found earlier in growth, that development takes place through the process of differentiation. This is the way of organic democracy, in which many parts of the total pattern gain independence and a permanent individuality, while at the same time they contribute by their very diversity to the organization of an ever widening range of new patterns of behavior. Viewed alone, a single differentiated function, whether on the level of reflexes or learned skills or concepts, represents a process of conservation of past experience. Such patterns gain their individuality, and they continue to maintain it, only through their functional relations in larger organizations of experience.

"All for each and each for all" remains the organic law under which individuality of function may be attained and maintained. In the chapters immediately following, this process of differentiation is given further consideration in the study of thinking and problem solving.

SUGGESTIONS FOR NOTEBOOK AND BULLETIN BOARD

1. Organize a series of illustrations that indicate the changes that have taken place in our educational procedures for teaching reading or arithmetic or some other subject. Point out the tendency to provide a richer and broader experience for children out of which the particular skills involved may gain a richer meaning.

DIARY OF YOUR OBSERVATIONS

1. In the mirror-drawing experiment suggested in this chapter, you used, of course, the hand with which you usually write. Use the other hand, and repeat the experiment. Compare your first efforts with the left hand with those with the right, which we will suppose was first used. Compare the rate of improvement of the left hand with that of the right. Did the

left hand profit by the learning of the right hand? Account for the facts.

2. Try to teach a child who does not know how, to write his name. Make a record of your observations which point to the way the child's efforts tend to become specialized as he uses less of his whole body and confines his activity largely to the use of one arm.
3. Make a record of several of your own experiences in which the "what's-that" quality was present. You may be able to find yourself in such a state when waking in the morning or when suddenly surprised. Note how these unorganized states are succeeded by more organized states.
4. Repeat Köhler's experiment with the candy and boxes of different shade intensities. You and others in the class may be able to use children of advancing ages and thus may get at least a general idea of the age at which children change their mode of learning, from the more primitive method of boxes-in-relation, to the discernment of the particular quality of the box in which the candy is placed.

SUGGESTED READING

1. Koffka, K., *The Growth of the Mind*, pp. 139–159 (Harcourt, Brace & Company, 1928) gives interesting and significant evidence of the nature of primitive conscious experience.
2. Freeman, G. L., *Introduction to Physiological Psychology*, Chap. 8 (Ronald Press Company, 1934) gives a brief survey of levels of neural patterns and their relation to various levels of behavior as we observe them in life.

Chapter Nine

The Thought Processes

A brisk November wind carried the first snow of the year. Down the street came a five-year-old boy, with his mother and his dog. The situation seemed to arouse in the three a great difference in meaning. The mother and the dog were taking it as just another of those nasty cold days, and they were glad to be hurrying home where it was warm. The dog went on ahead, and the mother followed, turning her face from the storm as she hurried along. To the boy, however, this November snowstorm was a new and glorious experience. He jumped about and exclaimed, "Look, Mother, look, the snow is round!" He took off his mittens to let the snow pellets strike his bare hands. He turned his face into the wind and tried to catch some of the little round pellets in his mouth.

The boy hurried to catch up and tried to get the dog to share his enthusiasm, but the dog refused to frolic in the snowstorn. Then, as is the way with small boys, the dog's unusual behavior started a series of questions.

"Mother, why doesn't Buster like the wind and snow?"

"Buster is cold; he doesn't wear warm clothes as you do."

"But I have my mittens off, and I like to have the snow hit me in the face."

"Yes, but you have on lots of other clothes to keep you warm. And you had better put your mittens on again and keep your hands warm or you may catch cold."

"Why don't dogs wear clothes?" This with a twinkle in his eye.

"It would cost too much to buy clothes for dogs. Our charity had better go to help poor people buy clothes before we put them on dogs."

"What is charity?" And the boy was away to another venture, this time out from the immediate reality of snowstorm and clothes into a world of thought where these realities become organized. The snowstorm was forgotten as they entered the house and his mother explained the meaning of charity.

"It's charity when you give clothes to poor people who need them."

"Are clothes charity?"

The mother was nonplused for a moment, then reminded the boy of food that they had recently given to a man at the door. She mentioned the sticker on their front window which indicated that they had given money to the Community Chest. She explained that in this organization many people unite to buy clothes, food, and coal and to pay the rent of poor people. With these examples as a background, she was able to give the boy a fairly clear idea that charity exists when people who sympathize with the poor give them whatever they can to relieve their needs.

The boy, however, was not satisfied until he had explored further possibilities of this business of giving. He had many more questions: "Didn't we want the money we gave to the Community Chest?" "Why are people poor?" "Were you and Daddy ever poor?" "Will I ever be poor?"

The mother continued to explain; and before the father returned to take up the burden of answering questions, the boy not only had a better notion of the meaning of charity but had some notion of the relation it has to sympathy and need. All of which had its beginning in a cold November day with its driving snow pellets and a dog that would not play with him as usual.

Learning through Thinking.—This incident reveals the way in which thinking follows upon the heels of sensory presentations and reorganizes and patterns experience. Wind and snow became the starting point for considering clothes and warmth. Dogs and human beings were contrasted, and charity was seen in the setting of this and several other actual situations. Then, in turn, charity was seen in relation to human sympathy and human need, which were matters that had been closer to the boy's experience than had charity. The lives of children are filled with this game of question and answer in which they sort out and then organize the dominant relations between things and events that are parts of experience. From the stream of experience children thus develop concepts—concepts of things, concepts of people and of self, and abstract concepts which deal with relations between these.

Sensory Presentation and Thinking in the Stream of Experience.—It is difficult to determine just where sensory presentations leave off and thinking begins. Both are phases of the stream of experience and are interdependent. In the last chapter, it was shown that much of the sensory stimulation of everyday life may be lost in this larger stream, leaving little evidence of its occurrence. For example, we sleep on a Pullman and soon get accustomed to the noise and motion. We go down a crowded street, daydreaming or intent upon a problem, and give little heed to the noise about us. The boy was intent on firsthand experience with driving snow pellets; then firsthand experience was lost in the stream of thought as he followed the quest for the meaning of charity.

A survey of our own experience over a few minutes of time reveals further the way in which the excitations from the sensory organs may or may not find a place in the stream of experience, how present thought may control the selection of sensory presentation, and how one thought follows another. At this moment, for example, I find that in the

course of the past few minutes many things have happened which only now get recognition because I look for an illustration. Busy with my writing, I had paid little or no attention to the snorty honk of the electric bus as it passed a half block away, to automobiles passing just outside the window, to the furnace being fired in the basement below me; and I realize only now that all this time the water has been dripping in the kitchen near by. None of these stimuli has been given definite recognition until the turn of thought brought me to looking for examples—then there they are, ready to become a part of the "going" stream of experience, destined even to dominate for a time the stream of experience.

My back is turned to the street, and so stimuli other than the honk of the bus make no impression. Yet this sound leads to a full, well-rounded presentation of the bus as it has been seen and heard and used in the past. Verbal description does not do justice to this recalled experience. The bus is large, blunt-ended but otherwise streamlined, light green and light yellow in color; two trolley arms angle upward to double trolleys overhead. There are windows, of course, and large double rubber tires fore and aft are streamlined with the sides of the body. The presentation is so loaded with meaning that the sound of the horn is lost in the complex pattern of which it is a part. In turn, the initial presentation and the beginnings of thought which quickly follow are lost in a deeper stream of thought. This bus is an innovation in city transportation, and once it gains the center of attention it persists in my thinking. Don't confuse it with an ordinary trolley car, and be assured it is quite out of the class of the noisy motorbusses that run on this same street. It starts quickly and quietly and swiftly picks up speed. Its seats are nicely cushioned and comfortable. It swings easily from the middle to the side of the road and back again; strange indeed to see those long trolley arms angle outward from the center of the street as this trolley car shows its independence of rails.

As you see, the automobiles, the furnace, the dripping water, and perhaps our writing has been subordinated for the moment to our very real interest in this electric bus. Furnace and automobiles do not now seem to warrant more than passing mention; but the water continues to drip, drip, drip, and we halt in our writing and go to turn the faucet tighter.

Back to our writing now. It should be noted that the successive phases of this experience are all integral parts of a stream of experience in which the main purpose of writing still holds the reins and gives direction, even if sometimes precariously, to all the experience. This finding of examples may be thought of as a unit of experience in itself, but it is a part of a larger unity of experience. As sensory presentations gave way to thought processes and the experience moved on, it was directed by the larger purpose of writing. The thought processes not only moved onward, but they broadened and deepened as they became better organized.

High Lights of the Thinking Process.—The reader is confronted every moment with examples such as that described above, in which sensory presentations and thinking are united in the stream of experience. An examination of such experience reveals several significant aspects of the thought processes. It is apparent that all sensory presentations do not have the same value in a given stream of experience. Some stimuli from the world without are quite lost; others, such as that of the electric bus, gain dominance, and still others, such as the dripping water, the furnace, and the automobiles, have less significance in the developing pattern. Thus, it appears that the thought processes are selective. Common experience reveals the fact that the thought stream widens its scope as it proceeds, one thing leading to another as new sensory stimuli lead to new sensory presentations and as rich past experience becomes a part of the present experience. It is plain also that the stream of thought takes pattern. It becomes organized about dominant elements, sometimes in ways that result

in the formation of concepts, conclusions, and judgments. The onward movement of thought and experience is a matter of prime significance and will be given consideration in Chap. X in which we shall study the way our thoughts and experiences take direction and purpose. In the present chapter, our attention is given to those factors which tend to make our thought more complex and to the accompanying processes of organization which at the same time make our thinking more unified and more useful.

Thinking as a Selective Process.—The stream of conscious life has its ups and downs, its eddies and crosscurrents. All kinds of outside circumstances present themselves and raise problems and create stresses that must be resolved through the repatterning of our behavior to make it consistent with these outer circumstances. The content of these patterns changes as our experience moves on. The boy's thoughts moved from snow and wind to dogs and clothes and then to charity. The writer in a search for illustrations recalled recent presentations from the honk of the electric bus and then much more of motorbusses and city transportation and returned again to the interest of the writing that had brought the bus into the thought pattern. In such experience, certain parts gain at times a place of dominance, as, for example, when thinking centered in the bus or when the boy's attention centered in people being poor. These parts gain form and become better organized as units, but they do so in relation to the larger stream of experience. They become differentiated in the true sense of this term, since they gain individuality in relation to a larger whole in which they are functionally related to other parts. This segregation of related parts thus implies their integration. As our thinking centers in first one thing and then another, not only do these particulars become clarified, but the larger whole moves forward and becomes better organized, a truly integrative process. As we shall see presently, the segregation of parts from the larger wholes of experience is the basis on which con-

cepts are formed, and concepts are, more than anything else, but convenient ways of organizing our experience for future use.

The Role of Consistencies and Inconsistencies in Concept Formation.—Likenesses and differences seem to be the key to the selective and integrative process which leads to the development of concepts. With the child, these are of course not the likenesses and differences commonly apparent to adults, which have become so freighted with meaning that it is difficult to appreciate what they were like in their initial stages. Likenesses and differences in the stream of experience have the nature of consistencies and inconsistencies; they are parts of experience that work together and parts that do not work together in furthering the business at hand.

The boy came to the November snowstorm situation with the meaningful experience of several winters behind him. He knew what snow was, but here on this November day he found, not the flat snowflakes of former winters, but instead round pellets. Flat snowflakes float down like feathers, but these came at him like thrown balls. He held out his hand to catch snowflakes, but found he must hold his hand quite differently to catch these rolling pellets. When he exclaimed, "Look, Mother, the snow is round!" he gave evidence of a significant segregation in his total experience with snow, a segregation that supplied the leverage for the repatterning of his concept of snow. In many respects, snow will continue to be to him what it had been before—it will still be white and cold, it will appear in winter, it will come down from above, carried on the air and the wind—but, henceforth, snow need not necessarily be flat flakes. Henceforth, snow is different, and the boy who caught the snow in his hands and mouth is different. Later, when he becomes adept in handling a sled, he will be still different. In other words, the change in the concept represents a change in the relation between the boy and snow.

Other evidences appear in the experience of the boy which show the interplay of likenesses and differences or, better, the interplay of consistencies and inconsistencies. There is the dog, without clothes and feeling cold, in contrast with himself and other people who have clothes and keep warm. There are the poor who lack the necessities

New Experiences in Snow Lead to New Concepts of Snow.

of life, and others who have plenty. Such differences are inconsistencies in the experience of the boy; they raise questions and create stresses that can be resolved only through the repatterning of his whole experience under the direction of his thought processes. To resolve these stresses, he must see things in a larger way than before if he is to live at peace with such inconsistencies as appear, for

example, in people giving money away when everybody wants it.

Segregation and the Generalization of Experience.—As the pattern of thought widens, it seems there is more need for it to become better organized if it is to be of use in guiding experience. As is usual in the organic world, increased complexity calls for better organization. Let us examine further the nature of this organization in the experience of the boy. He asked his mother, "What is charity?" because he did not see what charity had to do with the rest of his present experience. The mother replied to his question with a simple explanation: "It is charity when you give clothes to poor people." But this answer failed in its purpose, the stress persisted, and the issue was pushed further by the boy's question, "Are clothes charity?" It remained for the mother to broaden the base of thought by bringing in other examples. Seemingly, the examples made the situation more complex and more difficult of understanding, but in reality they led to simplification by laying a sound basis for the segregating from the various situations the likenesses that are common to them all. These likenesses represent the persistent consistencies that make charity what it is. In the situations that the mother used as examples, there are many differences. They differ and are inconsistent in the people who did the giving and the people who received the help; they differ in what was given and what was needed. But however much these situations may differ, they are alike and consistent in certain essentials that combine to form a stable notion of charity—there is someone in need of something, and there is someone who sympathizes and gives what is needed. These essential consistencies become dominant in a total pattern in which the differences are subordinated. From this complexity a new pattern is abstracted, a concept of charity that is like none of the particular experiences on which it is based but one that is consistent with each of them. Need and sympathy are

two other abstract concepts that emerge from consideration of the several examples; and with these two patterned together into a meaningful unit of people who sympathize giving to people in need, the boy gained a new power of understanding charity as it applies to many situations. Having organized his varied experience in this manner, he can meet these situations again and similar situations without being confused by their differences. Here again, segregation and integration are found as components in differentiation of new patterns in relation to larger wholes of experience.

How Concepts and Generalizations Function in Experience.—How well the boy's concepts were formed must be judged by the use he makes of them in interpreting new situations in which the relations involved in charity are at issue. If his generalizing was well done, if the concept is well differentiated and well integrated, the boy comes to new situations with his past experience conserved in the neat pattern of "people who sympathize giving to people in need"; he is thus organized for the business of understanding. New situations in which good judgment is needed about people giving are weighed in the balance in terms of sympathy and need. Displays of sympathy are measured against a yardstick of giving where there is need; people in need are seen in relation to people who can give, if they sympathize. Judgments about such new situations become sounder; behavior becomes more intelligent. As he makes such judgments, his concepts of charity, need, and sympathy become enriched and more potent. However well his first lesson may have been learned, there still remains much that a five-year-old may not understand about charity, need, and sympathy. There is need of maturation of this new pattern. New experience brings new kinds of problems, and their solution leads to a higher level of understanding as the concepts become patterned into a more stable, yet more flexible whole. In a certain sense these concepts are never fully formulated; we continue to profit by experience.

The Child's World Becomes Organized.—There is no field of human experience that escapes this process of unifying and generalizing of experience. The child develops concepts of all sorts of things, all sorts of people, all sorts of relations between people and things. He also develops a concept of himself, and, as we shall show more pointedly later, his concepts of self and things and people are related one to another. These concepts are developed, not out of thin air, but out of the stream of experience in which he continuously makes his adjustments to the world about him. His concepts and generalizations are the result of his organizing his relations with the world about him.

Children's early concepts are practical and intimately related to their firsthand experience. As they grow older, their concepts involve more and more of their experience, and the concepts become more abstracted, more removed from the reality of particular experiences so that they may apply consistently to many experiences. Ask a child of four what a table is, and he will probably tell you, "It is what we eat on." Three years later he will probably tell you, "A table is a piece of furniture, with legs and a flat top." In those three years, tables have been compared with other tables, some of which were not used to eat on. His former concepts are inadequate and inconsistent with his broadening experiences; he has come to see tables in relation to other articles of furniture. With the passing of time, children continue to broaden the range of their experience; they grow in understanding of things and people and self and the relations that exist between these in the flow of experience. Their lives grow in complexity but become better organized through the growth of concepts which pattern the consistent relations between self and things and people. Thus the child's world maintains its unity. In the pages that follow, several fields of human learning are examined to show further the way in which various kinds of concepts are formed and how they give leverage in the control of new experience.

Generalization of Number and Number Relations.—There is perhaps no phase of human experience that demonstrates more pointedly the principles of generalization than that of number and number relations. Concepts of quantity arise, as do all concepts, out of the interplay of consistencies and inconsistencies of experience. The child's world is filled with situations that offer an opportunity for this quantitative development. There is at first a more or less undifferentiated mass of playthings, furniture, and people; but with a developing preference for one toy over another, there comes an awareness of quantity and of numbers. A child will soon choose the larger quantity of things he likes to eat or play with, for the lesser amount leaves him hungry and the larger amount leaves him satisfied. Having all the candy he wants when he has a handful and wanting more when he has but one piece represent situations that lead a child to make judgments about the quantity of things in the material world about him. He is given a penny and finds that it buys one piece of one kind of candy but buys more of another kind. He learns that a nickel buys more than a penny and later learns that it buys five times as much as a penny, or perhaps more than five times as much. If we examine his experience carefully, we shall find that much of his life involves judgment of quantity. Under such circumstances, he begins to "keep count" of his "store of goods," knowing how many dolls or toys he possesses, how many pennies it takes to buy this, how much farther it is to one store than to another at which he can buy his favorite candy.

This quantitative aspect of life he finds complex. He lives in a world that adds oranges to other oranges and then takes them away again. He lives in a world of counting and measuring and keeping toll, in a world of exchanging goods for counted money or for other measured goods. As he grows in ability to do things, he grows in his understanding of how people live in this world that puts values on things. He learns to understand that there is more or

less of everything; so he learns to count, add, take away, multiply, and divide. His firsthand experience in these matters may be crude compared with adult standards, but in his own firsthand experience he lays the foundation for his concepts of numbers and number relations which give him power in understanding the widening sphere of his life.

It is no mean achievement to have gained a concept of what is meant by the number 4 or 5. Many peoples of the more primitive culture levels[1] have number systems that consist of but "1, 2, many." Some have advanced to a higher level by making use of fingers and toes as the instrument for taking their first step in generalization. Fingers and toes are always at hand; and although they are vicarious representatives of other things counted, differing in many respects from these things in size and shape and other qualities, they are nevertheless like these other things, in that they can be counted.

The development of the concepts of addition, subtraction, multiplication, and division, to say nothing of the other number relations and operations, belong to relatively higher levels of intelligent behavior. If there were plenty of things in this world to be had for the reaching and if all things were equally desirable, there would be no stresses that would lead to an awareness of quantity and therefore no development of concepts of quantity. Since there are limits to man's stores of goods, we find him measuring his experience within these limits in more or less accurate fashion. For these basic reasons, the child learns that 3 is "three," whether it be in respect to toys, candy, oranges, or what not. He learns that 2 is 1 less than 3 and that 3 and 2 are five. For the savage, there is the length of the journey measured in the number of sunrises and sunsets counted on fingers and toes whereas for civilized man there is the more accurate measuring of miles traveled recorded by a

[1] Tylor, E. B., *Anthropology*, pp. 309–316, D. Appleton-Century Company, Inc., 1916. Reprinted in Robinson, E. S., and F. R. Robinson, *Readings in General Psychology*, pp. 490–495, University of Chicago Press, 1929.

more precise schedule of hours and minutes, and interpreted through a more highly developed number system.

Evidence from Changes in the Teaching of Number.—Changes in educational procedure for the teaching of numbers and number relations give evidence of a growing understanding of the process by which number concepts are formed. There was a time when arithmetic was looked upon

(*Courtesy of Los Angeles Public Schools.*)

Here Numbers and Number Relations Are Close to Children's Interests.

as a mental discipline, and the rote memorization of tables and rules was accepted as the means of gaining a mastery of number and number relations. More and more of our schools today, however, make it their first concern to provide a rich experience in which the need of number and number relations arises. These situations have a setting in a schoolroom life that appeals to the natural interests of children and at the same time presents rich opportunity for children to understand the world in which they live. Number and number relations, of course, have a place in such a life, and there is thus ample opportunity for the

development of the concepts and relations in actual experience. Children take the initiative in learning under such conditions, and there is little of the mere mouthing of words of book or teacher which may have little meaning for the child. In the more modern procedure, number and number relations retain their natural relations to experience; the concepts arise from the experience, and they are used effectively in new experience in which there is a real need. There is no place in such situations for *mere* repetition. The purposeful life of the child provides the right conditions for the development of real understanding.

Maturation in the Development of Number Relations.—Nothing that has been said above discounts the normal activity of maturation through repeated use of newly developed concepts of number. Likewise, nothing that has been said should be interpreted as meaning that this development depends wholly upon firsthand experience of the learner. Our understanding of the learning process calls for firsthand experience as the initial basis for learning; but, as we have observed repeatedly, the thought processes soon depart from the situation at hand as they widen their scope and bring past experience to bear upon present issues. It is as natural for thought to rise above the immediate as it is natural for it to broaden by including more and more of new firsthand experience. Beginning with concrete experience, it is natural for thought to bring in the past experience of the learner and to go searching for like situations in the experience of others. The learner lives vicariously this experience of others, matching it with his own. This is the productive kind of repetition, the natural process of maturation of a pattern that has taken form but needs to be used in varied situations to bring it to a more adequate stage of development. When children live rich experiences in line with their interests, they sense the newness of developing concepts and naturally seek and devise new situations in which to use their newly discovered tool in order that the satisfaction of mastery may follow

the first pride of possession. Such maturations are not mere repetitions; for new meaning, significant, however small, arises from the experience. The concept changes in such experience; the generalization gains in stability and in usefulness as it comes to represent wider ranges of experience. Like the physical differentiations that result from growth, it is to be expected that these generalizations may lose their functional individuality through disuse. Just as an organ that ceases to be an integral part of the life of the organism loses its ability to function, so the responses to number combinations, no less than our concepts of charity, may lose their effectiveness through disuse.

Skills as Generalizations.—What a variety of skills one can find in human behavior! Skillful unraveling of a problem in logic; skillful use of number combinations; perfect accuracy in spelling; beautiful and flowing handwriting; perfect coordination in the running of a race, in the throwing of a baseball, or in the shooting of a rifle—these are skills that are widely varied in appearance. However varied they may appear, they are alike in being patterns of behavior well organized for their purpose and are the product of much experience in which this organization has been perfected; and in each case the process of perfecting has been the characteristic process of generalizing experience. The consistencies have been sorted from the inconsistencies and variations in experience, and the skill patterns are formed, as concepts are formed, out of the consistencies that are applicable to many situations.

The mental concentration required in the mirror drawing recommended in the previous chapter should give ample evidence that more than the motor aspect of experience is involved in the formation of skills. Note also the little girl learning to tie her shoes, brush her hair, and later in life properly dispose powder and rouge. These are neatly coordinated sequences of behavior that are dependent upon more than physical activity. They are purposed in a larger scheme of life in which they are continuously weighed in

the balance. Note the part that this wider relation plays in the learning. Faced with the need of a new motor skill, we may read descriptions of it, listen to lectures about it, and see it demonstrated by someone. Later, we find this preview helps greatly in the development of skill as we attempt the performance. The lectures, reading, and demonstrations serve to create the goal for which we may strive, and with our first attempts we evaluate our performance against this goal. We find that we have succeeded in part and failed in part. We find with our first attempts that the performance was not what it looked to be and that the goal needs to be changed in the light of our experience. As we proceed, however, we sort out of the total experience the parts needing most attention and try to perfect these parts. In learning the high jump, for example, attention may at one time be centered in the approach to the bar, at another time in the position of the body as it crosses the bar, at another time in determining the best point for the take-off. Each of these has been found wanting in some respect in relation to the whole performance, and we work toward the creating of a pattern of behavior in which the essentials are coordinated into one smooth flowing activity. In so doing, we drop from our efforts many an inconsistency that appeared in particular performances, and we seek to retain the consistencies of our perfected pattern. Here, as elsewhere in learning, the development of a skill is a process of segregation and synthesis of appropriate particulars into a well-organized whole that is suited to meeting new situations.

Common experience provides us with interesting evidence of the relations of parts to the whole in ordinary skills. If we become self-conscious as we enter a room in which there is a group of strangers, the usual smooth pattern of walking and talking may be disrupted and we become awkward. At such times we are in a position to sympathize with the centipede described in the following lines:

The centipede was happy quite,
  Until the frog, in fun,
Asked which foot went after which.
This wrought him up to such a pitch
He fell distracted in the ditch,
  Considering how to run.

It is a well-established principle in the teaching of skills that are dominantly motor that the learner should direct his main attention at the time of the performance to the goal, to the target that is to be hit, rather than to any part of his actions. Parts are thus kept in relation. The baseball coach is continuously reminding the young pitcher, "Keep your eye on the target." The pitcher concentrates on the batter before him and with the aid of the catcher chooses the particular curve and change of pace to meet the changing situation of strikes and balls called, the stance of the batter at the plate, and the disposition of the runners on bases. Then he keeps his eye on the target—keeps it there as he prepares for the pitch and keeps it there until the ball is thrown and the action of the batter has resulted in the strike, ball, foul, or fair hit. The target involves the whole situation; the batter and catcher and plate are the center of the situation, the bull's-eye of the larger target.

There are many mistaken ideas about skills which one may wish to change before one has concluded studying of them. Skills are generally thought of as simple and easy and to be perfected by mere repetition. It is quite commonly thought that when a skill is mastered it is a definite or specific response that is always given when a definite or specific stimulus is presented. The stimulus situation is supposed always to remain the same, as is the response, and the skill is thought to become fixed or automatized. To the casual observer, these erroneous notions may appear true; but from the viewpoint of the learner and user of skills these commonly accepted ideas are wrong and lead to wrong concepts of learning and of human nature.

Skills Are Highly Organized Behavior.—Let us examine closely one of these skills to see if there is a fixed sameness in the stimulus to which the learner responds or if, as a matter of fact, the same stimulus ever occurs a second time. Let us see if it is more reasonable to expect habits and skills that are useful in widely varying situations of life to be simple and fixed or flexible and adaptable. Let us see if the time taken to perfect skills is evidence of simplicity or of the complexity with which they are fitted into the whole life of the learner. Let us turn to Jimmie for our evidence.

Jimmie is a great admirer of Bill Martin, the home-run king of the local ball team. Jimmie and his father sat in the bleachers one Saturday afternoon when Bill knocked a home run over the right-field fence. Jimmie knows that this is not as easy as it looks. He finds that even "connecting with the ball" is difficult. At one trial, his feet get in the way; another time, he decides his hands are too far apart; and when he corrects these faults, he finds that other things have gone wrong. He has heard that Bill "hits from his shoestrings" and knows that this means that his whole body is put behind the swing of the bat. Jimmie has a real appreciation of the care with which Bill gets ready when he comes up to bat. As Bill approaches the plate, he swings two or three bats; even in this preparation, he works "from his shoestrings up," apparently getting all the nerves and muscles of his body tuned up for the highly coordinated work ahead. When he reaches the plate, he dusts his hands, grips the bat carefully, gets just the right stance, measuring his position by a tap of the bat on the plate, and, waiting for the pitch, keeps all his muscles in tune by swinging the bat backward and forward or by standing poised ready for the pitch. The pitcher may purposely make him wait too long, trying to catch him out of rhythm; when Bill senses this, he steps away from the plate and goes through the procedure of getting a new set for hitting the ball. If we should ask Bill

how he accounts for hitting these "simple" and "easy" home runs on Tuesday while he fans out on Wednesday, he may tell us that on Tuesday "everything was just clicking," but on Wednesday he was "a bit off form." By "clicking" he means that nerves and muscles were beautifully timed and coordinated. Bill will tell you that you have to be "all there" to bat some of the good pitchers of opposing teams.

Examples are innumerable, and right at hand in the lives of everyone, to show us that skills are complex and may be upset by some little part of the whole going wrong. People speak of their fingers being all thumbs today, of their feet getting in the way of each other, and we use many other expressions that indicate that skills are complicated and highly organized pieces of behavior and that they depend for their usefulness on the way in which they are integral parts of many larger wholes of human behavior.

The point of view that skills are complex rather than simple applies to behavior thought of as more intellectual than batting home runs. The combination 8×3 looks definite and simple, as does the correct response 24. It does not look as though it would be difficult to learn. It once was commonly taught with the other 8's in a table, 8×1, 8×2, 8×3, and so on to 8×11 and 8×12. How we used to "rattle off" those tables, and then found that when 8×3 came up in a problem we had to hunt out the answer, perhaps by repeating the table, perhaps by adding 8 and 8 and 8. Evidently, 8×3 was not yet learned so that it was right there when we wanted it, and it is very much a question whether it is really learned unless it be there whenever needed. In the hunting of it out of the table, we are demonstrating that it has some definite roots that go back into our past experience. It shows that we understood what 8×3 means in relation to 8×2 and 8×4. We also understood that it is three 8's added together. Out of understanding such as this and much more like it, and out of understanding how useful it is to have the

24 right there when it is needed—out of this relatedness to larger wholes of numbers and to varied experience comes our real mastery of 8×3. Repetition in a table or repetition out of a table without these vital relations will not lead to real learning. Skills deserving the name are rooted in a wide range of experience and for this reason are useful in a wide variety of experience. They are not simple. They work easily and effectively in varied situations because they have gained some significance in relation to our everyday experiences and our purposes.

A survey of the attitudes that different people have toward arithmetic reveals a situation that verifies the interpretation just given. Let a dozen or more people indicate whether they *like* arithmetic, *dislike* it, or are *neutral* in attitude. Have them set down offhand any reasons or circumstances for their attitude. It is surprising how many people are "against" this useful instrument. The individual cases are revealing. Here is a fine old lady, an "A" student in the author's class, who says she dislikes it very much; all these years she has never been able to forget a certain teacher who tried to "make her learn arithmetic when she couldn't." Here is a housewife who will not fill out the postcard that the meter man left—she doesn't know a thing about numbers, and yet she is a college graduate. A man reports failing in eighth-grade arithmetic; he never had been good in arithmetic—but he liked physics and chemistry, wished to become a teacher of those subjects, and because of the related mathematics became a "math shark" in high school and college. Our attitudes are indexes of the significance such skills have in our lives: skills are not apt to be effective, unless they are effective for something.

Language and Vicarious Experience.—The world of language into which children are born gives them an approach to both the real and the vicarious in life. From the first days of their lives to the last, they are surrounded by social contacts in which language plays an important part as a means of communication. Whether it be for child

or adult, life seems to be lived at least twice, once in the reality of doing and again vicariously in the telling or writing about it, or perhaps in reading another's version of it. Adults turn to the morning paper to read of the meeting that they attended the night before. Children tell their experiences to one another and their parents. Parents relive their lives with one another. Businessmen review their achievements with their associates. Listening, the other party to the social contact lives vicariously the experience of the one who tells the tale. To this firsthand sphere of communication there is added the inexhaustible supply of newspapers, magazines, and books that record the experience of other people far removed from our actual sphere of living.

Speech a Part of Man's Basic Behavior Pattern.—Children come to this language-endowed world with a basic behavior pattern that includes the capacity for speech. Animals manifest some small degree of ability for communication through vocalizations, but human beings are unique in their capacity for evolving and using language. What more conclusive evidence is needed for this universal capacity than the hundreds of dialects that are found over the face of the earth? Even though their adult companions are constantly using other words for the same objects and experiences, children invent words in the course of their early development. They soon reach a period when the naming of objects, actions, qualities, and relations becomes one of their chief activities. During this period, they become language-conscious, and their questions of "What's this?" and "What's that?" are apt to mean that they want the name fully as much as they want information and understanding of the thing named. These names that concern them so vitally may have been heard and understood before, but the language has been an integral part of their experience and not until this period are words differentiated from the larger setting and given independent standing in the conscious life of the child. Once on its way, this

interest in language continues, as evidenced by such activities of childhood as giving nicknames and the pleasure that even adults manifest in such games as charades and crossword puzzles.

Language and the Formation of Concepts.—The crux of our understanding of language as it functions in human experience is our viewing the language aspect of experience as one of the many segregations that are made in the forming of concepts. To the child, chairs differ one from another, but certain qualities are consistently found in all of them and from these consistencies is patterned the concept of chair. The name *chair* is one of these persistent aspects of their experiences with chairs. Children's first definitions are those of use, but the language aspect of experience is used quite as much as any other. To a child of four a chair is not only "what we sit on" but what people call a chair, and the calling is many times the key to its being used to sit on. Later, a chair may be thought of as a piece of household furniture that stands on legs and has a back; but, again, it has not only the constant distinguishing qualities of legs and back, but also that distinguishing quality of being constantly called *chair.*

The same unique place for the *name* is found in actions and relations as well as in things. Dancing, walking, talking, and other activities have their distinguishing characteristics, among which is the name of each that is persistently used to identify it. The relations that are implied in such words as *forward*, *back*, *up*, *down*, and the like, become difficult to define in terms of use or classification, but they have definite connotations as they enter into our experience. *Upstairs*, *up on the mantel*, *up in the tree*, and *take me up* are language forms that symbolize realities of experience in which the relation *up* plays a consistent role. Through use in many situations children become aware of this *up* relation that exists between many things, they themselves many times being one of the related things in the patterns of experience. This relation becomes consciously segregated

from larger units of experience, and the symbol *up* takes form and meaning.

In these concepts of relations and actions, there are lacking many of the tangible qualities such as those found in the legs and tops of tables; indeed, in most of these concepts there is no quality or part of experience that is more definite, more firsthand, and more consistent than the names that are used. Since these abstractions are patterned largely from qualities of experience, they tend to draw away from the objective realities of things and people so that the concepts become in a sense unreal. The names of these relations are, however, very real. They have been commonly used in many experiences, and they continue to be used as the key to conveying meaning.

Language Symbols in the Thought Processes.—Names, whether of objects, actions, relations, or highly abstract qualities, are not only most convenient symbols for communication between one person and another, but they also facilitate the thought processes themselves. Common experience gives the best of evidence that the stream of thought may be very sketchy. It may not draw to it anything like a complete reconstruction of past experiences; it does not bring into full awareness a well-rounded representation of the concepts that have arisen from experience; instead, it seems sufficient for many purposes to have these concepts represented by a mere detail or clew which permits the easy handling of many concepts without the confusion that would arise from masses of details. Language symbols are undoubtedly the most common representations or cues of such concepts and experiences. This may well be so, for they are true representatives of the experience in which they have played a part. They are at the same time definite and simple in themselves, and they have been much used in social contacts as symbols for the conveying of our thought to others. Other cues besides those of language may enter into the thought process, such, for example, as the fleeting visual presentation of flakes of snow,

the equally fleeting auditory presentation of dripping water, the smell of roses, the taste of a favorite apple, the feel of soft fur, or the pinch of new shoes. It is plain, however, that words spoken, words heard, and words seen may likewise be the cues for concepts of objects. Language cues are in their nature useful in swift-moving thought processes; they represent the concepts of objects, and they are particularly useful in representing concepts of relations.

Educational Implications of the Psychology of Language. This view of language as a differentiated aspect of experience carries some very significant implications for education. If a language symbol is to function effectively, it will be because of the meaning that arises with its use in the thought processes. Thinking, concepts, and cues of concepts have value to the degree that they aid in the control of behavior. Thoughts are weighed in the balance by being matched with actual experience. Concepts and cues used in thinking must ring true to reality. It is therefore important that language symbols have their origin in actual experience and, as symbols of experience, be true representatives of it. Practical judgments and action are the goals of thought; and if the symbols used do not represent realities, there is little assurance that the thinking will result in a safe guide to behavior. How often we find this fact verified in ourselves and others as some friend halts us in a deluge of words that has lost touch with reality!

This point of view implies that worth-while experience should have given a sound basis of meaning for words and the concepts which they symbolize, but there is a further necessity, that developing children shall have an opportunity to use these symbols to bring them to the fullness of their meaning. It is a common occurrence to find that the telling of an experience throws new light upon it, and in this repatterning we may discover significant relations which will become helpful in future experience. The boy's persistent questioning about charity, recounted at the beginning of this chapter, is an example in point. A live

conversation is both stimulating and exacting in matching our words and deeds with the thoughts and the experience of others. In a spirited argument, we find language the social tool which cuts into ill-formed concepts and gives them character. There is ample justification on these grounds for doing away with the deathlike stillness of children in schoolrooms, substituting for it the busy hum of work and

(*Courtesy of Milwaukee State Teachers College.*)

Language Ability Is Challenged And Developed in a Wholesome Group Enterprise.

the conversation of open councils in which expression of all kinds has a natural relation to the developing enterprise in which the children are vitally interested.

Dangers of Verbalization.—Too many of our homes and schoolrooms are organized on the listening-post–sounding-board plan. There is no psychology to justify the old precepts that "children are to be seen and not heard," and that they should "speak only when they are spoken to." Some parents and teachers end the day worn out with their own continuous talking. The speech of the children has meanwhile been parrot language, speaking back to the

teacher words that are anemic in their dearth of related meaning. Such meaning as arises is built out of the juggling of words; the oral explanations of children are like echoes from the sounding board or are meaningless reports of experiences of someone else found in books. Thus, words are piled on words to explain words, with little foundation in the pupil's firsthand experience and firsthand interests. Such verbalization results in hazy ill-patterned concepts and in generalizations that may be far removed from the realities of life which wait just outside the doors of the schoolroom. Thus, for example, youngsters study geography from a book assiduously, but they may be astounded to find that altitude has any relation to their own experience in going up and down elevators or taking drives into the mountains. The dictionary is a useful tool in learning; but, like many other tools of learning and teaching, it cannot take the place of a firsthand experience. We agree with Dewey as to the position of the book and reading in education—"harmful as a substitute for experience, it is all-important in interpreting and expanding experience."[1]

Modern practice in our better schools has parted company with silence and with the verbalizations that have so often been mistaken for real learning. Rules and procedures in arithmetic now grow out of varied experiences of the learner, rather than being verbalized starting points of teaching. The beginning of reading, for example, is based upon the actual experience of children, this year with a frog that a child brought to school, next year with a trip to a farm or zoo. There is much enlightening conversation centering in their experiences which children are eager to put in record form, printed with pictures, "just as other people do." The reading of these records becomes a fitting part of the whole experience, and maturation becomes the handmaid to learning as these children read and reread these intimate records of their own experience. Naturally, there is a desire to compare their experience with similar

[1] Dewey, John, *School and Society*, p. 76, University of Chicago Press, 1915.

experiences of others, which brings a fuller meaning to the experience at hand. Under such conditions, speaking, writing, and reading become integral parts of worth-while living; and, under these conditions, language and the language arts develop, not as something apart from life, but as a vital part of it.

The Values of Firsthand Experience.—In recent years, our better schools have changed their procedure so that they offer much more experience of the firsthand order than formerly. More and more of the materials of actual life are being brought into the schoolroom, and more time is being given to firsthand contacts with the outside world through taking children to see interesting and significant examples of our social and industrial life. The experiences of children in the best of these schools is something more than the mere observation of the social and industrial products and processes; they are given an opportunity to become participants in the life about them. Under such conditions, the life of the school loses much of its artificiality, and the living becomes rich and broad and searching in its trend. These developments constitute a validation of the principles of learning herein set forth. Such a school life provides the right kind of setting for real learning to take place. The firsthand experience of the children becomes the nucleus of a widening and deepening experience. They are acquainted with the grocery store, the bakery, the post office, and their homes, but they know them only superficially. More than the mere presence of the concrete and the immediate is necessary for learning. Mere contiguity in time and space guarantees nothing of real significance. The store with which they have been acquainted becomes quite a different thing when children see it from "the inside out," as they do when they organize a store of their own. The school bank with its realities of books kept and money actually deposited and withdrawn in the child's own account brings other banks of the community within his comprehension as they never could

be otherwise. Naturally, the units of living so engaged in by children are not artificially bound within the usual 15- or 20-minute class schedules; enterprises started today may continue for weeks. Here, again, the procedure is in harmony with psychological principles; opportunity is given for children to return again and again to the situation from which their generalizations are being made, so that they try out and test the products of their previous learning in a wide variety of situations.

Practical Guides to Learning.—Thus it appears that in guiding child development and learning, parents and teachers are beset with danger on two sides. On the one hand, there is the error of expecting children to learn without an adequate basis in firsthand experience, and on the other hand that of relying upon a mere succession of firsthand experiences without providing the conditions for generalization in which sound concepts are formed. Our study justifies the conclusion that experience is the basis for learning, experience that is on the level of the present ability of the children and within the field of their present interests. This experience should begin with the real; it should be firsthand experience and vital to the learner. From this beginning, the experiences of the children move outward naturally into the varied and richer experience of others, derived from firsthand social contacts and from books. Under such conditions, worth-while learning results in significant generalizations which organize experience. In such situations, the way is opened to make real the vicarious. These vicarious experiences lie in wide reading, in dramatizations, in construction, in the collection and arrangement of pictures and objects of interest, in organizing and conducting their own business enterprises, and in other activities that bring the realities of other lives into vital relation to the child's own experience, even though he cannot be an actual participant in the realities that they represent. Looked at in one way, such vicarious experience represents the normal process of maturation; it is more

experience in kind with a developing pattern. Worth-while patterns of behavior may require time to take form, and they will certainly take even more time to develop into their fuller possibilities so that they will be useful leverage in the further interpretation of life. Children should be encouraged to engage in enterprises that will challenge their interests over long periods of time, rather than those activities that are short-lived and isolated from the main stream of life about them.

Summary: Our Broader Concept of Learning.—In the early chapters, a picture of human development was drawn in which the growth processes laid the basis for life in differentiated patterns of behavior that are essential to mere existence. Through the growth and maturation of these basic patterns, the human organism is made ready to meet the standard human environment; it is prepared for the usual. Growth develops the typically human types of behavior, and learning adapts the individual human being to the enormously varied situations that confront him in life. Man's capacity to learn is revealed in his inventive achievements, and his civilization has so increased the complexity of his life that he finds his capacity to learn challenged to the utmost. We are greatly in need of all the insight on learning that is possible.

Under such circumstances, we view the best learning as that which increases one's ability to learn still more. We judge the worth of present learning, not only by its success in making the adaptations necessary to meet the present situation, but likewise on the basis of how much it will add to our ability to meet the needs of the future. In other words, learning is at its best when it lays the basis for more learning; it is at its best when it lays the basis for the intelligent behavior of the future as well as of the present. It is, of course, the nature of the learning process to do this very thing; our efforts to understand learning should result in giving intelligent aid to nature's own way of doing things.

The normal processes of learning are essentially no different from the normal processes of growth. We have found the evidence of this fact as we have examined the nature of sensory presentations and likewise of the thought processes. Growth proceeds from the simple and undifferentiated to the differentiated and complex. At all stages, the process hinges on the functional relations of developing parts with other parts, working within the larger whole as it maintains relations with its environment. These growth processes result in an organism whose behavior has the complexity essential for experience on the mental level. Sensory presentations are the products of this complexly organized whole. Stimuli from the world without excite nerve endings in sense organs and set up excitations that are caught up in the stream of neural energy in the brain. Out of the complexity of this stream, experiences rise to the level of awareness or consciousness. Our study of the mental experience of sensory presentations reveals the same laws operating as were found operating in the growth processes. Sensory presentations are processes of differentiation, beginning with simple, undifferentiated orders of experience which develop into more complex systems through parts emerging from the more neutral ground and taking form in relation to other parts. The patterning initiated by sensory presentations tends to continue and may become thinking. In the thought processes, we find the same organic laws in control, the stream of thought developing from the simple to the complex with sensory presentations and the conserved patterns of previous experience made one in the flow of new experience. Parts differentiate within the whole, so that in the face of increased complexity the thought stream becomes better organized. This process of reorganization is called generalization, and its products are concepts, skills, and interests.

Thus, it appears that at all levels of adaptation human behavior becomes organized upon a whole-to-part basis.

Learning is not specific, if by this is meant that we learn things in isolation. The products of learning tend to become specific, if by this is meant that they gain individuality as differentiated units functionally related to other units within a complex, larger whole. Learning is essentially relational; it is essentially a process of differentiation; it comes through the reorganization of the stream of experience. It is a whole-to-part process in which the organism becomes adjusted to the circumstances of life through the reorganization of the total behavior and the development of first one part of the total and then another. In this reorganization, dominant patterns are developed from the consistencies of varied experience; past experience and vicarious experience join with present firsthand experience to form a broad base on which concepts and generalizations are formed.

Maturation is nature's mode of bringing patterns of behavior to fuller functioning power. A newly formed concept is intriguing to adults as well as to children; we exploit the new-found ability to see how it works. Such maturation is not mere repetition; the mere contiguities of time and space are not crucial in such maturation. Organization from experience, in experience, of experience, for future experience—this is learning; maturation is the search for more experience that is essential for the development of the new pattern of behavior.

The practical implications for parent and teacher of this view of learning may be summarized in the following way:

1. Let there be experience. First, let there be experience that is firsthand, experience that is in keeping with the present interests and abilities of the learner. Let this firsthand experience be broad and rich and vital.

2. To this broadening base of firsthand experience, let there be added vicarious experience from finding the answers to questions that have arisen, from reading, from dramatizations, from enterprises of the learner's own in which he builds and uses his hands, and from other means

by which the learner projects himself into the experiences of others and brings new insight in turn to his own living.

3. Let the learner do the generalizing. Parent and teacher should be but helpers in setting the stage for the process of learning. Do not talk generalities, at least not until the questions of the learner indicate that his thinking approximates your level. Provide the setting, and then give time for concepts to develop.

4. Work with nature in the maturation of new patterns; expect questions and more questions; expect the seeking of more experience. Let the repetition, the so-called "drill," be in line with the natural processes of maturation, which means more and varied experience in which the new pattern is tried out and at the same time reorganized in further details. Skills are not automatizations; they are high-class differentiations.

5. Last but not least, look upon any learning as an incident in a larger whole of life. It is one phase of the development of a human being, of a developing personality. Modern life is complex, and unity and integrity of personality are at a premium. Respect the personality of the learner; respect the whole of life, and let learning and maturation of the particulars take place with a view to the developing whole.

In the chapters that immediately follow, we shall be concerned with interpreting further this organization of the individual, with the way experience is conserved as memory and habits, with the way his life takes direction and is organized with reference to goals.

SUGGESTIONS FOR NOTEBOOK AND BULLETIN BOARD

1. In its very nature the process of concept formation does not lend itself to pictorial illustration. It is a process of abstraction, a selective process that pulls away from the realities of particular experiences. The possibilities of illustration therefore lie in depicting the variety of experiences out of which

particular concepts might be drawn. Thus, it might be valuable to illustrate the range of experience out of which the child of three draws his meager concept of *chair* and to contrast this with the broader experiences from which the richer concept of the seven-year-old child arise.

2. Skills, like concepts, are differentiations from varied experience. At first, they are limited—limited in the range of experience out of which they have been formed, and limited in the range of experience in which they can be used successfully. It should be possible, as it is not for concepts, to illustrate the several levels of development of a skill, such as walking or talking, and to show the relation of these levels to the experiences from which they arose and in which they may be expected to function.

DIARY OF YOUR OBSERVATIONS

The content of this chapter opens up rich possibilities for the observation of learning in children of different ages. The suggestions that follow are only a few of the possibilities:

1. Bradley, a boy of two years, has been much interested in automobiles which he calls *ca'*, and in trains, which he calls *choo*. Standing in the back yard, he hears the noise of an airplane overhead. He is not familiar with airplanes, and he turns this way and that, saying, "Ca'?", then "Choo?", and then after a pause, "No, no!" Make a record of observations comparable to those noted above, revealing the nature of the experience children have in forming concepts. For older children who can ask questions, the evidence is more easily seen.
2. Can you find a child who is at the stage of naming things?
3. Can you find examples of children who have invented words that are used for definite purposes? Can you find evidence of the continued interest in this game of language as children become older and grow to adulthood?
4. Make a record of an experience of your own in which you have been forced to reorganize and refine your concepts. Note the re-sorting and reorganization of the consistencies that go into the new pattern. Have some of the consistencies in the pattern of the old concept become inconsistencies that have been excluded from the new concept?

5. Make a record of a schoolroom or back-yard enterprise of a group of children, and evaluate it in terms of the practical implications found at the end of this chapter.

SUGGESTED READING

1. The reference to the article by Benezet, L. P., given on page 210 of the last chapter are particularly applicable here. Note especially the difference in ability of children in different schools to give clear expression to their thoughts. What are the implications of this experiment as far as language teaching is concerned?
2. In *Educational Diagnosis*, Thirty-fourth Yearbook of the National Society for the Study of Education, 1935, Chap. 10 is concerned with "Maturation as a Factor in Diagnosis." The first sentence gives the cue to the contents: "The purpose of this chapter is to discuss educational growth as biological maturation: . . . " The article may appear technical, but underneath the whole discussion the reader will find respect for the natural processes of learning.
3. Turn to Robinson, E. S., and F. R. Robinson, *Readings in General Psychology*, pp. 507–517 (University of Chicago Press, 1923), for some very interesting excerpts from various authors, all dealing with the nature of concepts and concept formation.
4. Koffka, K., *Growth of the Mind*, pp. 339–352, (Harcourt, Brace & Company, 1924), contains an excellent interpretation of beginnings of language development. These pages contain many interesting examples that show the close relation which names hold to the objective world in early years.

Chapter Ten

Conservation of Experience

Fortunately, human beings do not have to begin life all over at the beginning of each day; we do profit by experience. Fortunately, too, we do not have to remember all our past experience. It is well that many things are forgotten, for it would be impossible to keep everything in order if all were remembered. This is true not only of mental activity but also of other phases of human adaptation. The changes that take place through growth are conserved, but only in part; many an organ fitting to one stage of development disappears or is modified as other organs develop. The processes of conserving and eliminating are found in basic behavior patterns, such as the sucking of the infant, which in time becomes reduced to a habit of thumb-sucking and then disappears as the child begins to eat solid food. Habits and concepts and the things remembered at four years of age become inadequate for the eight-year-old; those that are not completely forgotten are many times lost as they are incorporated in new form in the expanding stream of life. The personalities of children change; interests change; concepts change; habits and skills change; the memory of the past changes.

What are habits? What is memory? What are the differences in learning and in remembering that account for the differences in the permanence and usefulness of knowledge and habits?

What Is a Habit?—The word *habit* is used with such a wide range of meaning that one may be easily confused, not knowing in what sense it is intended. We speak of habits of posture that are dependent upon the way muscles and bones are joined together. We speak of habits of walking, habits of talking, habits of thinking, habits of looking at problems, and habits of attacking them; and we speak even of habits of sleeping and dreaming. When we speak of habits of posture and of walking, it is hard to separate what is a part of the inherited behavior pattern of the individual and what is the product of learning that has been stabilized through use. Habits are generally considered products of learning, but sometimes we find authors writing of organic habit, meaning thereby that as an organism grows so it tends to remain. We even hear of inorganic habit, this referring to the tendency of nonliving matter to remain in a given form unless it is acted upon by forces or conditions from without. Thus, coat sleeves tend to keep their wrinkles, salts form in characteristic crystals, and frost on windowpanes takes patterns and keeps them. Such examples, of course, supply evidence of the dynamics in nature that change these patterns, as well as of the *force of habit* which conserves them; with changed conditions the frost formations vanish, the crystals fuse or dissolve, and the wrinkles may disappear if the coat is left to hang or is worn by another person. This extension of the meaning of habit to include in its scope the inorganic and the inherited patterns of behavior, somewhat general though it may be, not only serves to emphasize the conservation of patterns in nature but also points to changes that come with changed conditions.

Habits and Other Generalized Experiences.—Our concepts of tables and chairs, of charity and justice are in a sense, habits. They stay with us as relatively stable units of our experience. Our well-formed and persistent attitudes and our interests may be looked upon as habits. Skills are commonly recognized as the best examples of habits.

Our study of skills in the last chapter indicates that they are generalizations, unworthy of the name if they do not function in varied situations. Concepts are likewise generalizations; they are good when they give leverage to the interpretation of new situations. Interests and attitudes, as will be shown more definitely in the following chapters, may become fairly stable parts of our lives; they are adaptable and lie close to the changing purposes of developing lives. Learning at its best does more than just adapt to the situation confronted; it results in the union of the present experience with past experience and is pointed toward the future. Learning tends to generalize experience, thereby creating concepts, skills, habits, interests, and attitudes that stand ready and expectant of more experience. In all these generalizations, there are two essential aspects that make them of worth; one of these is the fact that past experience is conserved and organized into a unity that gives some guarantee of its persistence, and the other is that by generalization the experience of the past retains a capacity for entering dynamically into future experience.

The same characteristics that make concepts of worth also make habits of worth. They are stable and persistent patterns of learned behavior, but their value depends upon the way they function. Stability and persistence in behavior are good, bad, or indifferent, according to the way they serve in meeting the problems of life. It should be remembered, too, that there is a higher law of differentiation in which habits, like other products of learning, can help in lifting organisms to higher levels of flexibility and adaptability. In accord with this higher law, we may call habits good if they serve as a base upon which the stream of experience is deepened and broadened, if they continue to lead to a better understanding of the world about us, if they enhance the development of personality.

How Bad Habits May Be Changed.—We learn much of the nature of habits when we try to change a bad one. Let

us test out the concept of habits by considering a particular case. Molly is a seventh-grade girl who has some bad habits in arithmetic. She persists in making mistakes in simple addition and other fundamental operations that she should be able to do easily and accurately. For example, if she is to add 8 and 7, she may get the sum wrong much of the time, and it takes her a long while to figure out what the answer is. Naturally, while Molly is slowly worrying through this simple addition, she is forgetting the details of the problem in which it appeared; she says she "gets all muddled up." She has been urged in school and at home to do better. At home, her failures are recognized as a serious problem, perhaps taken too seriously; her father has told her that he understands what a hard time she is having, for he had the same trouble with arithmetic. Her mother, she is told, was never good in arithmetic, either. "Arithmetic just doesn't run in the family, on either side of the house," her father assures her. Such ill-advised sympathy has much to do with the fact that Molly has a defeatist attitude toward arithmetic. She does not seem to try, is not interested, and tells her schoolmates that she hates it. Thus, Molly's bad habit involves more than not being able to say or write 15 when 8 and 7 are presented for addition.

It is very plain that the correction of Molly's difficulty will involve her whole attitude toward arithmetic. The father would do well to take her into his office some Saturday morning and show her the figuring he has to do in his business. The mother, who is interested in music, might point out that many of the best musicians have been mathematicians. Of course, some careful work must be done by Molly and her teacher in finding out what is wrong with her way of adding 8 and 7 and in discovering a better way of doing it. Her teacher discovers that she has an involved procedure that is anything but a good habit or skill. Molly tediously takes 2 from 7 so that she can add it to 8 to bring it up to 10, which seems to have the virtue of a convenient mental resting place; from 10 she can go on to 15

by adding the 5 which was left after she had taken the 2 from the 7. One would imagine that over a period of years Molly would have become disgusted with this rather absurd procedure. Arithmetic, however, has not had a setting in Molly's life that is conducive to improvement. Molly's case being an actual example, it is possible to say that Molly spent a summer finding out what was wrong, finding better ways of doing arithmetic problems, and, most significant of all, finding that she could get a lot of satisfaction and pride out of doing "those horrid old things" right.

In general, we may say that to break a bad habit we must replace it with a better one. We may be sure that this will not be done by good intentions alone. The matter had better be attacked intelligently, so that the learner finds out just what is wrong and just what is right and thus sees the difference between the two. Most important of all, the whole procedure should be related to the things in life that the learner counts as worth while; in fact, it is just such useful relations that make a habit a good habit. It should be observed that this common-sense view is fully in keeping with the interpretation of habits as differentiations that must arise out of relations to larger wholes of experience and must be maintained through such relations.

Memory like Habit Tends toward Generaliziation.—Memory is one of the ways in which we conserve experience of the past. Habit is more completely generalized and more firmly established than memory. Memory is concerned with the recall of some particular experience, but habit represents generalization from many experiences. For example, we say that we have our own individual habits of walking, but we have the memory of a particular leisurely stroll taken at a certain time and place. In recalling the stroll, we may recall other particulars of the occasion, certain people whom we met, the clothes they wore, what they said, and what we said. In the process of formation, habits, like other generalizations, tend to eliminate many details

of the varied experiences from which they arise. The new habit, like a new concept, is evolved out of the consistencies that are applicable to these varied experiences. Note, too, that memory follows somewhat the same process. Though memory is concerned with particular experiences, nevertheless it, too, tends to generalize; for some of the details of the experience are lost, but other more significant parts form the pattern which is remembered. Experimental evidence will be offered later to verify this statement, but it should be quite obvious that it is true. When we recall people we have met, we find clothes are dominant in our recollection of one person, mannerisms are dominant in our recollection of another, and the conversation we carried on chiefly dominant in our recollection of a third. What is uppermost in the original experience may account for the character of the recalled experience, but sometimes we recall things that were quite in the background at the time of the impression. At times, we change the character of the remembered experience when some detail gains a new significance. The original impression is but a part of our dynamic experience. We are impressed with situations differently at different times, and what is recalled and the way it is recalled depend upon the relation of these to the larger stream of experience. The remembered experience is a framework of the essentials of the original experience, which in the recollection may be filled in to greater or less degree, now in one manner and now in another, according to our interests and activities at the time of recall.

Four Phases of Memory.—In its interpretation, memory is commonly considered as having four phases: the impression made by the original experience, the retention of the experience, its recall, and the recognition of the recalled experience as having been our experience and as having happened at a particular time and place.

It is difficult to think of impressions without thinking of their retention. There is much reason for believing that some degree of retention is involved in all impressions; in

other words, there are reasons for believing that no experience is completely lost. Some experiences may seem only tiny rivulets flowing into the great stream of experience; but if the rivulet becomes a part of the stream, the latter will be changed to some degree, however small this may be. We find plenty of evidence that our behavior is influenced by many factors of which we are not definitely conscious. These hidden factors are sometimes like small rivulets that start to break through the banks and eventually change the course of the main current. In our study of sensory presentations, it was found that the undifferentiated background against which the patterns of conscious presentation are set is an integral and significant part of the experience. In studying the thought processes, it was found that there is a continuous flux of the conscious pattern, with the elements at one time in the background coming forward into a place of dominance to replace others that recede to a less dominant relation. That these elements of the background of conscious experience are retained is proved when our friends ask if we noticed certain peculiar behaviors of a common friend; we reply that we had not noticed them, but on recalling the incident we find coming to our consciousness for the first time a definite recollection of the very things that had previously been given no attention. In a later chapter, experimental evidence will be offered to show the influence that such factors, present in experience but not apparent in consciousness, may exert upon learning. Suffice it to say that the impression phase of memory is concerned with the way our present experience is related to our present life, which in turn is organized about more or less permanent purposes and interests and habits.

Retention Is a Matter of Relations.—Why should some things be retained and others be forgotten? Why should the unnoticed and hidden impressions sometimes become the things remembered? We generally think that strong impressions are remembered longest; we generally

(*Courtesy of Los Angeles Public Schools.*)

Seeing Is More than Looking; Each Individual Sees as He Is Able, Takes Away What Is Suited to His Interests and Purposes.

think that we remember the most recent experience best. But these general observations explain nothing, and the exceptions to them point to our more basic law of relations that arise in the course of experience.

Let us take, for example, an actual experience. A firecracker bursts under our automobile as we go down the street. For an instant, our experience is dominated by the sensory presentation initiated by the explosion. Then, the thought processes interpret the situation, or the grinning face of an urchin at the curb saves us the labor of much thought. The next day in recalling the incident we find ourselves quite forgetful of that devastating first impression of the bang, which meant at first the possibility of a broken car, and instead we are intrigued with the grinning face of the youngster who threw the firecracker under the car. It seems very clear that the result of such an experience is more than being impressed by a situation represented by an outer circumstance. It is instead our individual patterning of the experience, which in turn determines what will be retained.

Further illustrations show that individuals react to the same situation quite differently. My friend does not remember the second song that the artist sang, and I am much interested in it. But I have little recollection of the last part of the program, for I had by that time become extremely fatigued and restless. Women remember what other women wear better than men. Some people remember names easily, and others have difficulty in remembering names but little difficulty in remembering faces. In short, both impression and retention of particular experiences depend upon the way they become incorporated in the lives of the people who have the experiences. When we say that we remember the things in which we are interested, we are at the very heart of the matter. The psychological laboratory has verified the experience of the courtroom in showing that people looking at the same incident do not see alike, or at least do not retain and report alike the incident to

which they testify. This is to be expected if we remember that these incidents are but phases of the different streams of experience of the different individuals.

Recall and Recognition.—Recall and recognition, like impression and retention, depend on the individual that remembers. In Chap. VII, reference was made to a sales manager who woke in the middle of the night and recalled vividly an error in quoting a price to a customer. The occasion that led to the error was a short cut in figuring. The incident and the resulting error were forgotten in the experience of the day; they had been lost in a mass of other details. But though they were not dominant factors at the time, they were nevertheless potent because of their relation to the life of the salesman. Errors of this kind are at cross-purposes with profits, which loom large in the life of a businessman; the owner of the business will look askance at a salesman who makes such mistakes; correcting such a mistake with a customer is an unpleasant piece of business and is to be avoided. The error, and therefore the incident from which it arose, were vitally related in many ways to the interests that the salesman holds in high regard. The recall of such an incident in the middle of the night can be accounted for only in terms of the potency of such relations.

In the salesman's recall of his error, there is also found the recognition phase of memory. The recall carries with it definite elements that fix the particular time and place of the experience and the realization, also, that it is his experience that is being recalled. The incident on being recalled is recognized as a particular experience; it is *that* experience of the morning before, and particularly in this case is the salesman aware that the error is *his*. This element of recognition is essential if the recalled experience is to be called a memory. The recognition phase of memory stands out when our friends insist that on a certain occasion we did this or that. After reflection, we finally acknowledge the truth, saying, "I guess you're right, I did do that."

Recall of the incident requires this element of recognizing the experience as our own, an experience that in the recall is given a location of time and place in our lives. Writers who unintentionally plagiarize give evidence of recall without recognition. In the same way, we find on occasions that we give expression to opinions as though they were our own, to find later that they have been borrowed from some past experience unknowingly; we *remember* when we are able to identify the behavior of the present as belonging to a particular past. Recognition stands out well on those occasions when we are provoked because we cannot "recall that man's name." The name that we wish to remember is elusive, but there is a keen awareness that it is *our* past experience with which we are concerned.

Experiments Concerning Memory and Habit Formation. Perhaps no phase of mental life has been studied more extensively than memory and habit. Some studies are concerned with the learning or impression phases of these processes, some concerned with the nature of their organization in an attempt to account for their retention, some concerned with the manner and effectiveness of their functioning in other experience and particularly with the extent to which one kind of learning may *transfer* and make other learning more effective. The remainder of this chapter is devoted to the review of representative experiments in these fields.

An Exercise in Memory.—Before we review these experiments on memory, let us first experiment upon ourselves. Prepare a piece of paper to cover the block of 16 letters that appears below. Look at the block of

R	*O*	*T*	*C*
B	*X*	*I*	*L*
E	*G*	*N*	*O*
F	*Y*	*S*	*K*

An Exercise in Memory

How many 10-second exposures of this block of letters are needed to "fix" it in your memory?

letters for about 10 seconds (let someone keep the exact time if convenient). Cover the letters, and for the next 10 seconds try to write them on a piece of paper. You have probably been told that concentration is essential to learning; try it here—use the full force of your "will power." Repeat the letters over and over to "fix them in your mind." After your first attempted recall, uncover the block of letters for a second 10-second period of observing them, and then on a new piece of paper write what you can remember of them in the next 10 seconds. Look at the block of letters again for 10 seconds, and then write again what you can remember, always using a new sheet of paper. Repeat this procedure of looking 10 seconds and writing for 10 seconds until you are able to reproduce the block of 16 letters without mistake. Do this before you read further.

When you have been able to reproduce the block of letters without error, then turn your attention to how you have learned and how you have remembered. Did you try to learn by mere repetition? If you began that way, did you not find that you were soon substituting more sensible and more effective methods? Your experience in organizing the letters may have been different from that of others, but without doubt you soon bent your effort to getting the first line ROTC to mean something, such, for example, as *R*eserve *O*fficers' *T*raining *C*orps. Did the second line BXIL become an abbreviation for *B*o*X* p*IL*ls; the EGNO an abbreviation for *EG*g *NO*g; and the FYSK an abbreviation for *F*l*Y*ing *SK*ating? Then, after getting the separate lines organized, did you find difficulty remembering the order of the lines? One subject solved this difficulty by building the whole into a story that went something like this: "The *R*eserve *O*fficers' *T*raining *C*orps man had to take a *B*o*X* of p*IL*ls and an *E*g*G* *NO*g for a cold that he got *F*l*Y*ing around *SK*ating." Another subject simplified the problem by making combinations of the four letters of each line and memorizing the whole

as a college yell, with pairs of letters organized into the cadence RO-TC, BX-IL, EG-NO, FY-SK.

There is little probability that the reader used the methods just noted for remembering the block of 16 letters, but some such method was undoubtedly substituted for attempts at learning by mere repetition, or possibly by "main strength and awkwardness." What constituted the impression in the exercise; what was it that could be repeated? Looking at the block of 16 letters does not constitute the kind of impression that is adequate for the purpose of retention. Mere repetition of the letters either by looking at them or by repeating them, however much we try to concentrate, does not go far in "fixing them" so that they may be recalled a few seconds later. The problem is one of evolving a pattern. One must learn before one can remember. Memory is the recall and recognition of the essentials of a pattern that has been organized and related to our larger experience. To be sure, the same block of letters remains as the objective stimulus, but for the learner the stimulus pattern changes in the process of learning. The change in the stimulus pattern, the change in the way the letters are organized, and the change in the way we attack the problem are essential factors in the experience as far as impression is concerned. We change our mode of attack; the letters change as we evolve them into a pattern. There is nothing static about the learner or about the block of letters as these are being organized into an understandable pattern. Naturally, the better the pattern is organized originally, the better it is retained and the better it is recalled. The word *better* refers here to the degree to which the evolving pattern becomes related to our interests and life purposes.

Learning and Memory in Lower Animals.—Learning and memory form an organic process, found in any organism whether the organism has a nervous system or not. We recall the description in Chap. IV of how the ameba learned to avoid the glass and the carbon. It finally learned its

lesson, but it did not remember it long. The short memory was entirely consistent with the simplicity of the organism and its habits of life. Many experiments such as those on the learning of the ameba have been conducted on low orders of animal life. For example, there are the experiments of Smith[1] on the paramecium, a microscopic organism. The usual behavior of this microscopic organism is to swim forward until it strikes an obstacle; then it backs, turns at an angle, and proceeds again. If necessary, it may repeat this characteristic behavior many times before it finally gets around an obstacle. Smith in his experiment drew the paramecium with some water into a capillary tube. In the narrow confines of the tube, it swims to one end of the tube and runs into air. To the paramecium, air is an unnatural medium and to be avoided, and so in its characteristic manner it backs at an angle and then goes forward again. The sides of the tube prevent it from turning to any great extent, and it again runs into air at the end of the tube. It repeats its characteristic behavior again and again, and then after many trials it bends and doubles on itself, thus making the turn in the tube. Here, however, it is confronted with the same situation of air and the narrow confines of the tube. By this time, it has partly forgotten its lesson, but it soon relearns it and turns to swim back to the other end of the tube again. It repeats this performance again and again; presently, it makes the full turn without hesitation when the end of the tube is reached. Like the ameba, it will soon forget its lesson, and like the ameba's its forgetting is appropriate to the simplicity of the organism and the scope of environment to which it is adapted.

Learning and Memory in Apes.—Going upward in the animal scale, we find that the more highly organized animals are able to learn more complicated behaviors and to retain for greater lengths of time what they have learned.

[1] Smith, Stevenson, "The Limits of Educability in Paramecium," *Journal of Comparative Neurology*, Vol. 18, pp. 499–510, 1908.

A more extended report of Köhler's[1] experiments with apes will appear later in Chap. XII, but it is fitting to note here that his apes learned largely in terms of situations that were immediately present before them; that is, their insight grew largely out of sensory presentations. They did not do much thinking when they learned, and their recall of what they learned, so far as can be judged by their behavior, came when they were again presented with the same situation or similar situations. For example, 13 months after they had completed experiments in selecting boxes by size, several of the apes found the fruit with not more than one mistake in 10 trials. Apes learn, they retain, they recall; we can only conjecture as to their recognizing the experience as their own.

Looking out for the future implies that one has learned from past experience. Köhler found that the apes when fed together soon got into the habit of grabbing as much food as possible and going to a quiet corner before they began eating. When they were put in their pens at night, they passed through an enclosure which at times was overgrown with weeds that they relished. As they were urged through the enclosure to their pens, they would make circuitous routes and gather as much of the green stuff as they could carry with them.

A more critical test of the memory of apes was given when Köhler buried a pear outside Sultan's cage while Sultan watched him. The ground was carefully smoothed over and an hour was allowed to pass, during which time Sultan was busy at play and apparently forgetful of the buried pear. At the end of the hour, when he was released into the enclosure where the pear was buried, he immediately made use of a stick thrown to him and unearthed the pear. He had the location almost exactly right and quickly corrected the first slight error. Tests similar to this were made on several of the apes, with time for remembering increased to the 16½ hours between the shutting of the

[1] Köhler, W., *The Mentality of Apes*, Harcourt, Brace & Company, 1924.

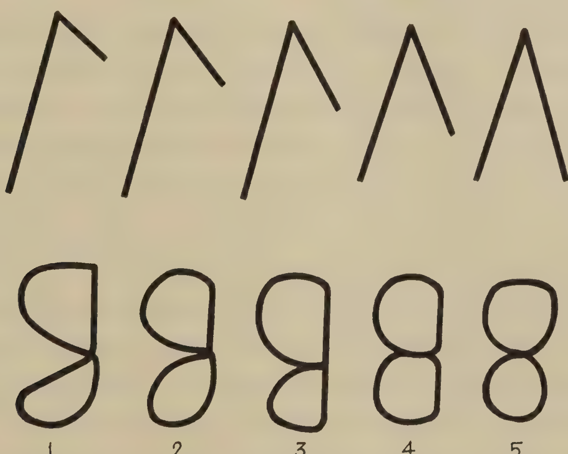
apes in their pens at night and letting them out next morning. In these experimentations the fruit was buried in a large open space, and in order to confuse the apes in locating the right hole, several other holes in which no fruit was placed were dug and then filled. All holes were covered and the whole area left in much the same condition throughout. Tested on several different mornings, Sultan, and then several of the other apes, went directly to the right place and dug up the fruit.[1] This appears to be a critical test as far as it concerns the length of time between the impression and the recall, but it should be noted that the recollection of the buried fruit is made in the setting of the original situation in which the impression was made. In a later chapter, reports will be given of other experiments which show that apes do little in organizing their experience in a way that would permit them to remember if the original situation were not before them. Their learning is firsthand, and the same limitations that condition their learning probably condition their memory. On occasion, human beings, too, find their recall dependent upon the stimulus of the original situation. For example, a person may get up from his work, enter another room to get something, and then find when he gets there that he has forgotten what he came for. To recall what it was he wanted, he goes back to the original room where, in the original setting, the impression is reinstated and there follows the recall of the thing wanted in the other room.

Changes in Pattern during Retention.—If we return to the scenes of our childhood after years of absence, we find that there is much difference in the realities before us and the memories we have had of them. The house in which we lived has not changed in size, but it now seems smaller. The old swimming hole that meant so much to us in youthful ventures has shrunken to a prosaic hole in a bend of the river. We find that in our absence from these old scenes our imagination has been playing tricks on us.

[1] *Ibid.*, p. 275.

We have idealized these early surroundings; in memory they have become larger than they are; we have read into them many attributes that they never actually possessed.

Remembered patterns are not always idealized; sometimes they are stripped down to essentials instead of being added to. Perkins[1] has shown by experimental methods the tendency to generalize the patterns during periods of retention. He permitted his subjects to look for 5 seconds at each of five cards on which were drawn in heavy black lines nonsymmetrical geometric figures. Twenty seconds after the series had been observed, the subjects reproduced the figures on blank paper. They reproduced the figures again on the second, third, ninth, sixteenth, twenty-first, and thirty-fifth days after the original reproduction.



Figures from Perkins' Experiment in Visual Recall.

Two samples from Perkins' experiment showing that in time memory tends toward more generalized, symmetrical forms. 1, reproduction after 20 seconds. 2–5, as recalled after intervals of 2, 3, 9, 16, 21, and 34 days. (*After F. T. Perkins, "Symmetry in Visual Recall," American Journal of Psychology*, 1932.)

What happened to the remembered figures during these intervals? In general, the irregularities in the figures became smoothed out, and they became more symmetrical. For

[1] Perkins, F. T., "Symmetry in Visual Recall," *American Journal of Psychology*, Vol. 44, pp. 473–490, 1932.

example, one figure which roughly suggested an 8 tended to become a figure 8. A large figure resembling an inverted U originally had one side shorter than the other; but the reproductions tended to equalize the length of the two sides, and the squared hook at the end of one side and the short straight line at right angles on the end of the other side tended to become two smooth hooks very much alike. Another of the figures originally was an inverted check mark, a long slanting line drawn at an angle upward to the right, with a short line continuing downward at an acute angle. During the retention period, these two lines tended to become of equal length and changed their angles so that they finally formed a tent-shaped figure. The accompanying figures show the general nature of these changes in the remembered forms.

Evolution of Patterns in Telegraphy and Typing.—The impression period of Perkins' experiment was but 5 seconds, and no further exposure of the figures was given. Quite in contrast to this experience is the evolving of the skills of the professional telegrapher and typist in which the same 26 letters of the alphabet are repeatedly before the learner. The actual copy before the operator, however, is always changing, and the final skill calls for a smooth, running adaptation to the changing words and sentences of the copy. In telegraphy, the skill may be considered as resulting in the appropriate activity of arms and fingers which impel the telegraph key as the sender clicks out the dots and dashes that stand for the letters in the various words. In the receiving of messages, the skill centers in the translation of the dots and dashes that are sounded out by the instrument into the letters which are combined by the receiver into words and sentences. In typing, the units are much like those used in sending the telegram except that the striking of a key reproduces a certain letter.

It becomes immediately apparent that, as a typist or telegrapher becomes skillful, he ceases to be aware of alphabetic units but becomes conscious of words, phrases,

and sentences which occupy the center of his attention. With the highly skilled operator, there are controlling units of a still higher order than words, phrases, and sentences as the work is done with greater awareness of the total context of the copy and of possible methods of organizing the work in better ways. In other words, there develops the ability to do several things at the same time. With this gain in skill, we find a change in the attitudes and purposes that control the whole procedure. The skilled receiver of telegrams in taking down a message does not try to keep up with the clicking instrument; in this period of lag between the sounding instrument and his transcription, opportunity is given for these higher orders of habits to become of use. In sending messages, as in transcribing shorthand, the skilled person runs his eye somewhat ahead over the copy and the striking of the keys follows after, so that time is given to organize the work.

It is this interval between the sensory presentations and the motor responses that makes it possible for the operator to adapt his performance to unusual situations that may arise. The receiver of messages has time to note the errors made by the senders and he corrects them in keeping with the context before he has written down that part of the message in which the error appears. The typist sees words with which he may have had difficulty in taking his dictation in shorthand, or he sees a difficult spelling ahead and is set for meeting the situation before the appropriate time for his fingers to strike the keys. These higher orders of organization are clearly revealed in the receiving of news dispatches in which there is much abbreviation and codification of familiar phrases. Here, the attention of the operator must be on the context and on the translation of the abbreviated cues in relation to the context, and the execution of the lower orders of writing or typing words and letters is marginal to this center of attention.

Such performances in their totality become highly complex behaviors. It is enlightening to discover through

experimentation how these different orders of behavior evolve, in other words, how a complex experience of this kind is learned and how these hierarchies of habit blend into finished performances.

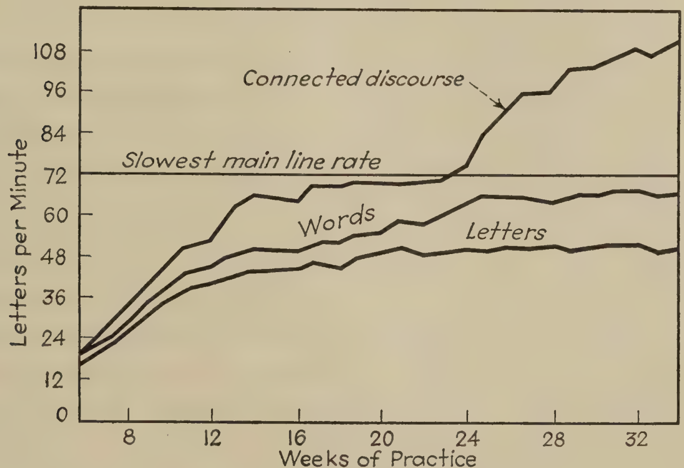
We shall examine briefly as examples of this type of learning the experiments of Bryan and Harter[1] in telegraphy and those of Book[2] in typing. The experimental results in these studies are recorded, in the main, in number of letters per minute sent, received, or typed, as the weeks of the learning period proceed. These data are supplemented by the reports that the subjects give of their experience during the learning. The data show, in general, a gradual rise in the number of letters per minute over a period of several weeks, followed by plateaus that indicate periods of little or no improvement, as evidenced in the measured results at least, followed again by another rise in the curve, showing gain in number of letters handled. The learning curves for the different skills differ in the rates of improvement at given times and differ in the time at which the plateaus appear. Most of the learning curves, however, are characterized by periods of improvement, followed by plateaus.

Interpretation of Learning Plateaus.—There have been many different interpretations of the plateaus in learning curves. Book located two plateaus in learning to type as coming with the transitions from lower to higher orders of performance habits. The learning in typing started with the location and striking of given keys to produce given letters, followed by the combining of letters to form words, followed later by the combining of letters or words into phrases as the working unit. Bryan and Harter concluded that, although the records of number of words per minute in telegraphy showed no gains on the plateaus, there was

[1] Bryan, W. L., and N. Harter, "Studies in the Physiology and Psychology of the Telegraph Language," *Psychological Review*, Vol. 4, p. 27, 1897; Vol. 6, p. 345, 1899.

[2] Book, W. F., *The Psychology of Skills*, Gregg Publishing Company, 1925.

probably significant learning taking place during those periods, the improvement being in the reorganization of behavior patterns in preparation for the higher orders of performance that were essential for further improvement. Some have interpreted the plateaus as being due to a lagging of interest, but this lack of interest may in turn be due to an awareness of lack of progress at this period in contrast to the improvement made previously; this interpretation leaves the cause of lack of progress still undetermined.



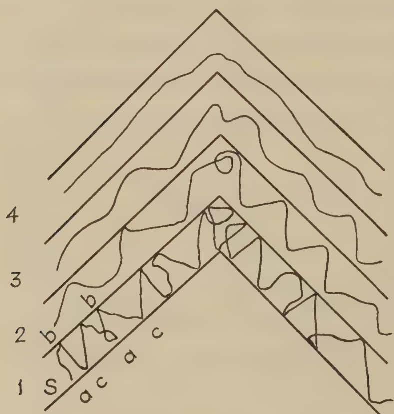
Plateaus in Learning Curves.

The three curves represent the rate of receiving telegraphic messages in the form of letters, words, and connected discourse. (*After W. L. Bryan and N. Harter, "Studies in the Physiology and Psychology of Telegraph Language," Psychological Review, Vol.* 4, 1932.)

Other interpretations of the plateaus point to a progressively new stimulus pattern as essential for the maintenance of continuous improvement. By this new stimulus pattern is meant the continuous reinterpretation by the learner of his goals and purposes so that his efforts are intelligently directed to the formation of higher orders of performance units.

This last-mentioned interpretation of plateaus places the emphasis upon the attitudes of the learner; that is, it

emphasizes the importance of the relations of the performance to larger behavior patterns and life interests of the learner. It throws into contrast procedures based upon unintelligent repetition of the particulars of the performance as compared with the progressive re-formation of goals in the light of the increased understanding that arises from what has been learned. Let us note some of the experimental evidence on this interesting and practical point.



Progress in Mirror Drawing.
Four tracings at one of the corners of a larger figure: 1, at the beginning; 2, 3, 4, at different intervals in the practice to show the improvement. (*From R. H. Wheeler and F. T. Perkins, after Snoddy, Principles of Mental Development, The Thomas Y. Crowell Company*, 1932.)

Snoddy[1] asked his subjects to trace star-shaped figures by mirror drawing, some of the subjects practicing continuously during the experimental periods and others resting at intervals. The latter, the group with the rest periods, learned more rapidly than the former, particularly in the earlier stages when the performance patterns were first being organized. The subjects who practiced continuously tended to a disorganized performance which Snoddy calls an *irradiation pattern*. The reader may possibly recall such experiences in the mirror-drawing exercise given in Chap. VIII, when in trying to direct the pencil around a corner there seemed to be an utter loss of sense of direction, resulting in random movements. Snoddy found, also, that the subjects who had rest periods made steadier progress. From the oral reports, he concluded that during the rest periods opportunity was given for new stimulus patterns to form, that is, that the subjects saw

[1] Snoddy, S. G., "An Experimental Analysis of a Case of Trial and Error Learning in a Human Subject," *Psychological Monographs*, Vol. 20, No. 124, 1920.

their job in a bigger way and returned to their practice with new goals and new purposes. The rest periods thus became a significant part of the learning process, for in them the various activities or parts of the experience had an opportunity to become better related to larger patterns. This process of reorganization is similar to that found in the experiments in telegraphy and typing in which the plateaus seem to be occasions for the formation of higher orders of habits.[1]

Kirkpatrick[2] conducted experiments that have a bearing upon the question of maturation and the organization of behavior into larger units. The learning in the experiment was the multiplication of one-place numbers by 7. The children who served as subjects were divided into two groups, with quite different conditions under which to learn. One group memorized the combinations of 7's in table form for 5 or 6 days before they used their knowledge in practical situations. The second group, called the *work group*, was engaged at all times during the experiment in multiplying by 7 the two-place numbers between 17 and 53, with no time given to the memorization of the combination of single numbers with 7. The mastery of the combinations of single numbers with 7 was thus incidental to the larger situation in which they were used. The test of improvement for both groups was the learning of the single-number combinations of 7. Until the tenth

[1] Snoddy extended his experiments in mirror drawing (*Evidence for Two Opposed Processes in Mental Growth*, Science Press, 1935) and suggested that two processes are involved in the development of new patterns. *Primary growth* dominates the initial stages of the adjustment; this growth never regresses, it improves with time—the longer the interval between practices the greater the improvement. These are the characteristics usually ascribed to growth. Snoddy's *secondary growth* has the characteristics commonly found in learning. This secondary phase follows and is based on the primary; it improves with practice and finally becomes the dominant factor in the learning; it regresses with time—the longer the intervals between practices, the greater the loss. Snoddy's data show the simultaneous operation of these processes.

[2] Kirkpatrick, E. A., "An Experiment on Memorizing Versus Incidental Learning," *Journal of Educational Psychology*, Vol. 5, pp. 405–412, 1914.

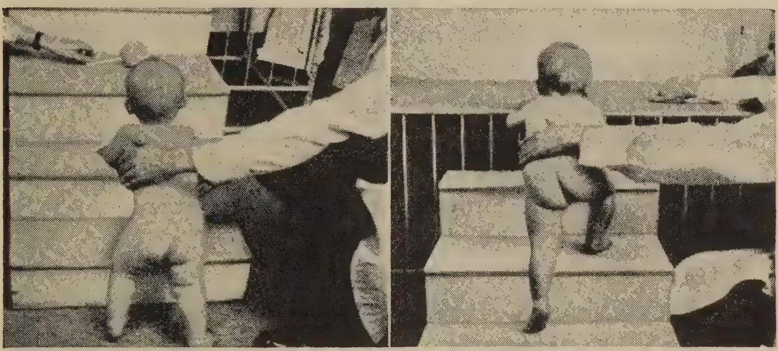
day, the memorization group gave more right answers in the 2-minute test periods than did the work group, but by the tenth day the work group had overtaken them. After a period of 2 weeks, they were again tested and at that time the memory group averaged about 41 correct answers in the test period to an average of about 46 for the work group. Similar experiments with adults resulted in even greater differences, the memory groups averaging about 25 correct answers to about 44 for the work groups. These experiments may well be interpreted as showing the relative potency of learning based largely on repetition as compared with learning situations in which larger and more purposeful performance patterns are given an opportunity to become organized. In these more purposeful performance patterns, a framework of habits of a higher order is developed and within this framework the lower orders of habits become more effectively organized.

Time Factor in the Maturation of Basic Patterns.— In experiments concerned with the development of basic behavior patterns such as walking and talking, the experimenter has the opportunity of letting nature set the stage for his experiment. In the development of such patterns, learning and growth are closely allied. A study of a few such experiments shows what happens when the conditions of natural development are varied experimentally, and from them we gain some idea of the relative influence exerted by the maturation of growth patterns and by learning. It is of course difficult to decide upon the part that learning plays in the development of such performance patterns, but this fact makes the experiments of no less worth in revealing definitely the processes of maturation.

Let us turn to a review of a few experiments conducted at the Clinic of Child Development at Yale University.[1] These particular experiments are concerned with the development of a pair of identical twin girls. The behavior

[1] Achilles, Paul, *Psychology at Work*, Chap. 2, "The Study and Guidance of Infant Behavior," by Gesell, Arnold, McGraw-Hill Book Company, Inc., 1932.

patterns of stair climbing, handling blocks, and learning to talk were the particular activities studied. One of the twins was given periods of training which were not given the other twin. The latter was used as a control or basis for making comparisons in results. The trained twin is designated as *T*, and the control twin is designated as *C*. The experiments in stair climbing and cube handling began before the twins were a year old. Beginning with the forty-sixth week after birth, for 6 weeks *T* was trained



Stair Climbing at 40 Weeks and 56 Weeks.
At 40 Weeks the Average Child Does Not Climb the Stairs; at 56 Weeks the Pattern Is Well Developed. (*From A. Gesell and H. Thompson, Infant Behavior.*)

10 minutes a day in handling cubes and climbing stairs, while *C* had no such training. In the third week of training (forty-eighth week after birth), *T* scaled the stairs with some assistance; and at the end of 6 weeks of training (fifty-second week) she was rated as an "expert climber." When *C* was tested at the end of the 6 weeks, she could not climb the stairs even with help; but a week later (fifty-third week) when confronted with the stairs, without any training and without any assistance, she climbed them. The trained twin was at this time much the better climber, but *C* was then given 2 weeks' training and became at the end of the training nearly as effective as *T*. When this comparison was made of their performances, each was 55 weeks of age. Motion-picture films were taken of the

performances at different ages, and it was thus possible to make a careful analysis of *T*'s performance at the end of 6 weeks of training (fifty-two weeks of age) and compare it with *C*'s performance after her 2 weeks of training (fifty-five weeks of age). This comparison shows that the results of *T*'s 6 weeks of training ending at the fifty-second week were more than equaled by the 2 weeks of training given to *C* at the later period, ending at the fifty-fifth week.

The case for maturation is even more pronounced in the handling of cubes. After 6 weeks of training given *T*, and with no such training having been given to *C*, it was found that in handling the cubes *C* was fully as proficient as *T*. An analysis of the films during *T*'s 6 weeks of practice shows a steady improvement in the various performance patterns in cube handling, but nature was evidently providing for a commensurate development of these patterns in *C* without any practice.

When we turn from the so-called *motor performances* of stair climbing and cube handling to the development of speech,[1] it might be expected that training would result in significant advantages over maturation. The same twins were used in this experiment. Beginning with her eighty-fourth week, *T* entered upon a 5-week period of training; then, at the end of this 5-week period, *C* was given a 4-week period of training. *C* thus had 1 week less of training than *T* but started with an advantage of 5 weeks' more of age. The results showed *C* to be more effective and more mature in speech than *T*. The untrained twin *C* used less baby talk, less doubling of syllables such as *ba-ba* for *ball*, did less confusing of one word with another, learned with less repetition, developed new words more readily from her childish jargon, and made a wider use of words at an earlier period. These are certainly most significant advantages; they point to the great influence that growth and maturation may exercise in such develop-

[1] Strayer, Lois C., "Language and Growth," *Genetic Psychology Monographs*, Vol. 8, No. 3, 1930.

ment. Interesting experiments on other twins are reviewed in Chap. XV, the results and interpretations being quite in keeping with those reported here.

Maturation an Essential Sequence Both to Growth and to Learning.—The interpretation of experiments such as those just reviewed may center in the changes that take place in the learner or may be viewed with respect to the thing learned. Whichever point of view is dominant in the interpretation, the other will quickly become involved. In growing children, all manner of changes are taking place through normal growth processes. Over a period of 6 weeks, or any interval of time, the child is not the same child on any two succeeding days, (1) because of the growth taking place and (2) because what he has learned makes him a changed person. One step taken by the child in attempting to walk results in a changed condition for the next step to be patterned by the learner. The inner organization of a growing child changes from day to day, and the outer situations change as he changes. The same stairs and the same cubes may be repeatedly in the presence of *C*, seemingly unchanged minute after minute and day after day; but stairs and cubes are but outer incidents in the total behavior pattern. The stairs before *C* in the fifty-second week of her life did not evoke a response; the total stimulus pattern did not therefore follow. A week later, however, the stimulus pattern of stairs-to-be-climbed did form, and stairs were climbed. The difference in these stimulus patterns may be due to growth or perhaps to added experience and learning. *T*'s 5 weeks of speech training seem to have been ill timed; training was not well coordinated with natural development. In like manner Snoddy's subjects in mirror drawing needed time between trials in which the pattern might become organized. In both cases the contact with the outer stimulus needed to be paced with the natural inner development. What does it matter that in one case these organizations appear as a result of growth of children while in the other cases as concerned with the

learning of adults? In both cases there was need of time, time providing the opportunity for factors of inner life to become better organized and making it possible for them to function in relation with the situation presented.

Understanding of human adaptation can be reached through various avenues of approach, but none is more significant than this in which maturation is seen as a continuing process of differentiation following the original formation of new patterns in growth and in learning. Our adaptations to environment are made, not by parts of the organism in isolation, but by the whole organism. There is every reason to believe that these continuing processes of refinement are essentially processes of differentiation, in which specific abilities become better organized and at the same time contribute thereby to a reorganization of the total behavior on a higher level. Here, as always, such processes lead to more complex performance; the habits become organized on higher levels and within more comprehensive patterns.

From the point of view taken throughout this study, the maturation and refinement of particular parts of behavior imply the reorganization of the larger whole of the life of the learner. Particular learnings must develop as differentiations, which implies the raising of the total behavior pattern to a higher level with greater capacity for adapting to new situations. Therein we find the basis for understanding why Snoddy's mirror-drawing subjects profited by rest periods; why *C* with the aid of a few weeks' growth to her advantage could be the equal of *T* in cube handling and could quickly overtake *T* in stair climbing; why *T*'s training in speech, ill timed with reference to natural development, leads to irradiated patterns comparable with those of Snoddy's subjects who were not given time to become organized in mirror drawing.

When we see the particulars of learned behavior as differentiations within a larger pattern, the various interpretations of the plateaus of learning are not contradictory.

One interpretation comprehends them all; plateaus represent periods in which newly differentiated units are becoming more fully related to larger units and to the whole of behavior. Maturation is the continuing organization of these total relations. With this improvement in organization the particulars begin to take care of themselves, releasing attention for the higher orders of relations. Thus, the telegrapher is able to delay the transcription of messages and thereby gain a higher order of control over the errors made by the sender. The well-individuated subunits of performance in such a situation are accurate because they are integral parts of a larger organization. The telegrapher comprehends the total project from details to higher purposes. He knows what to expect under changing conditions. The details of his work are patterned within this framework of major adjustments to his work.

Differentiation and the Problem of Transfer.—This progressive advancement of performance patterns to more comprehensive and better organized units differs not a whit in its essential nature from the process of generalization and concept formation that engaged our attention in other chapters. We are dealing with much the same problem, with the same principles governing growth and learning. Human behavior is a unity; it rises to higher orders of performance, either of thought or of overt behavior, through its capacity for differentiation. The formation of concepts gives the larger view and makes possible the easy and effective interpretation of particular situations. Skills and habitual performance patterns make possible the easy execution of what is to be done only when the situation is understood. We live effective lives when our habits are organized in hierarchies that reach to the level of purposes and are broad enough in scope to provide an adequate framework for lesser habits and skills. As will be shown more definitely in another chapter, our interests are just such higher orders of habits within which there are comprehended broad purposeful dispositions of

ourselves in large fields of experience. Our life purposes and ambitions are still higher orders of habits. With such an interpretation of human learning in mind, we turn to the old question of transfer, the problem of how one experience and one learning may have a bearing upon other experiences and other learning.

A brief historical sketch[1] of the experimental study of transfer of training should give perspective and point up the issues in this problem. Volkman in 1858 trained subjects in discriminating whether two points were felt on the skin as two points or a single point. Fingers of the left hand were trained and as a result discrimination increased from .75 line[2] to .45 line; the right hand, however, without any training improved from an original .85 line to .4 line. The use of the same neural patterns in the same hemisphere of the brain was thought to account for this transfer. Training of the fingers, however, did not increase the power of discrimination in the arm, indicating a difference in organization. Fechner at about the same time showed that learning to write with one hand greatly facilitated learning with the other hand. Scripture in 1894 showed that this "cross-education" applied to training in the speed, force, and accuracy of movement. Again, the probable explanation was the degree to which these activities, under the dominant control of a single hemisphere of the brain, involve much the same neural experience. The fact that there was not full transference was thought to indicate that the patterns are not wholly identical. It should be noted that the training in these experiments involves relatively simple experiences.

James in 1890 found that practicing the memorization of one selection of poetry did not improve the ability to memorize another selection. Ebert and Meumann in 1905

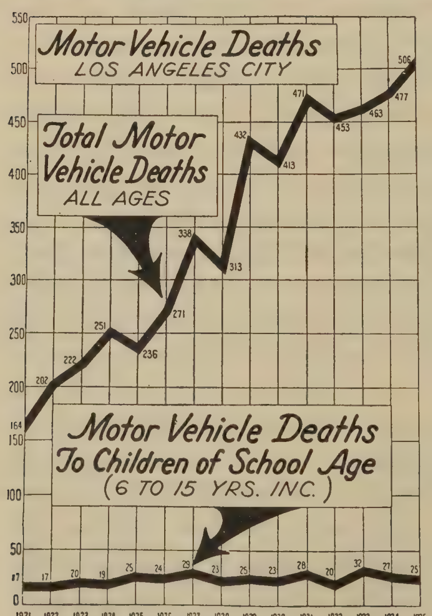
[1] Ladd, G. T., and R. S. Woodworth, *Physiological Psychology*, pp. 401 *ff.*, 565 *ff.*, 581, Charles Scribner's Sons, 1911.

[2] *Line* is a unit of measure used in the psychological laboratory; it is about 1/10 inch.

found transfer in different degrees in the training in nonsense syllables and the memorization of letters, numbers, disconnected words, passages of prose and poetry, and meaningless visual characters. Dearborn in 1909, using these same materials, showed that much of the improvement that had been attributed to transfer could arise from the single trial at the beginning of the experiment, aided, of course, by the processes of maturation that followed such a first trial.

Fracker in 1908 showed that the subject developed various methods by which he avoided the interference and confusion purposively introduced into the experiment by requiring him to pay attention to a second set of material before he had an opportunity to organize and recite a first set. The experiments put emphasis upon the development of methods of work applicable to different types of material rather than upon looking for common factors. At about this time the common-factors interpretation began to share honors with the interpretation that higher orders of behavior may control those of lower orders. Weir in 1902 and others showed through ingeniously arranged experiments the operation of these two factors of transfer, (1) that of common elements and (2) the development of higher orders of habits such as methods of "going at the job," ways of organizing work, and the development of general attitudes and habits of attention. These higher orders of behavior were thought of as supplying the common framework for a wide variety of lower orders of performance which might or might not have common factors.

If we turn from experiments to actual life, we note that the higher orders of habits do provide the general framework of our lives. People develop abilities in their chosen fields of work that far outstrip their abilities in other fields. Their interest in their chosen fields involves these higher orders of control. Actors develop a remarkable ability to learn their lines. Traffic managers remember a



(*Courtesy of Los Angeles Public Schools.*)

Instruction Like the Above Supplies the Larger Framework for Good Safety Attitudes and Habits.

The Graphs Show the Results of Education. Below, Children of School Age; Above, All Ages.

great number of train schedules and connections. Accountants develop methods that compare with the short cuts of the skilled telegrapher. In all these cases, we commonly account for at least part of the unusual abilities by referring to the interests and higher orders of understanding which constitute the framework within which the lower orders of specific skills are organized. In such an accounting, we shall ultimately give recognition to the kind of personality that the individual possesses and the way this personality is projected through attitudes and interests and purposes to influence wide ranges of activities. Obviously, performance varies in the degree to which such purposes become a dominant factor; obviously the same amount of interest does not attach to all the things we do. Thus, though we find our life ambitions and purposes influencing in a general way all our activities, we shall nevertheless find these varying in their potency in one behavior as compared with another. Our behaviors thus vary in the amount of interest that they elicit and in the dynamics that enter into them. The emotional factor in experience is of course highly significant.

Summary: Experience Conserved within Higher Orders of Organization.—The problem of transfer turns out to be one way of looking upon the problem of learning. When experience is well organized at the time of learning, such experience becomes of greater influence in future experience. An experience is well organized when it has become an integral part of the larger stream of experience of an individual's life. A particular learning situation is a minor current within this greater stream. We may note parts of one experience as "identical" with parts of other experiences, but it takes more than our noting this "identity" to make them effectively organized in the stream of experience. We do not remember just anything, but things that are in keeping with our present needs, that are in line with a developing or permanent interest. Thus, too, habits are good habits when they make possible a more complex

behavior or thought process by contributing to the development of a framework within which the specific skills are coordinated and directed to worthy goals.

In such learning, we find repeated on a higher level the drama of organic development in which the organism and its behavior become more complex through the process of differentiation. In such differentiation the particulars of behavior gain a differentiated independence. They tend to become specific, but their existence and usefulness, as with all differentiations, rest upon the fact that they are organized with many other differentiated behaviors within a larger unity of the life of the individual personality. In the following chapter, learning is considered as a goal activity in which these particulars are seen as functional parts of the moving stream of experience which is forever concerned with meeting and solving problems of one kind or another.

SUGGESTIONS FOR NOTEBOOK AND BULLETIN BOARD

1. Make a collection of illustrations that show the wide variety of behavior to which we apply the term *habit.* The illustrations might be organized in parallel columns, with examples of good and bad habits in the respective columns.
2. Select some activity in which you have a personal interest, such as collecting stamps, gardening, cooking, studying history or some other subject, skating, playing football or some other sport, and organize a series of illustrations that show the manner in which the particular skills and habits are organized in a framework of higher habits, such as larger interests, attitudes, life purposes, and plans.
3. Organize, perhaps in connection with the first suggestion made, a series of illustrations that show the maturation of some habit or skill, such as those used in sports. The maturation of such skills is a good illustration of the necessity of organizing them in hierarchies to make them effective.

DIARY OF YOUR OBSERVATIONS

1. If possible work with a younger brother or sister who has some bad habits in arithmetic, such as those of Molly, de-

scribed in this chapter. See if you can locate the particular difficulties and find what broader understandings must be developed as a foundation for the correction of the particulars, the changes in attitude necessary for constructive attack on the problem by the youngster, and finally the higher orders of interests and purposes that may be used to provide the framework within which the particulars may be expected to become organized.

2. Make a record of your own experience or that of some other person to show the nature of memory. This should point out the particular circumstances of the experience that is recalled to show why it was significant, the nature of the circumstances under which it was retained, the nature of the circumstances under which it was recalled, and the personal aspects of the recall which make it definitely recognizable.
3. Your diary should contain the record of your experimentation with the block of 16 letters which is outlined in the text of this chapter. You may wish to select other letters and possibly organize a group of letters into a different geometrical arrangement, such as a triangle.
4. Record any personal or observed experience that parallels that of the salesman who recalled his error in the middle of the night. Account for such recalls in terms of the larger whole of experience and personality in which they have their setting.

SUGGESTED READING

1. The chapter by Courtis, S. A., in the Thirty-fourth Yearbook of the National Society for the Study of Education (referred to at the end of the last chapter), is again called to your attention. The concept of learning as being a process of maturation is wholly in keeping with the interpretation of habits and memory developed in this chapter.
2. Wheeler, R., *Science of Psychology*, Chap. 10, pp. 269–300, gives an interesting discussion of the nature of memory and reviews an ample sampling of experimentation in this field of study.
3. Robinson, E. S., and F. R. Robinson on pp. 135 and 136 of their *Readings in General Psychology* have taken excerpts from the writings of Jennings and Herrick which give an interpretation of the basic nature of habits much in point with the development of this chapter.

4. The student will wish to read all of Chap. 2 which Arnold Gesell contributed to the volume edited by Achilles, Paul, *Psychology at Work*, (McGraw-Hill Book Company, Inc., 1932). On p. 34 and following are descriptions of the development of behavior patterns such as the reaching for and grasping of a pellet. The whole chapter emphasizes the operation of the natural maturative processes in the development of children.
5. McGraw, Myrtle, *Growth*, pp. 3–14 (D. Appleton-Century Company, Inc., 1935), gives a summary of the various approaches to the study of child development. The student reading this summary will gain perspective and a better organization of his understanding of the basic principles that have been developed in our study.

Chapter Eleven

Thinking and Learning Take Direction

What assurance can one have that thinking will solve one's problems? What assurance is there that learning will result in worth-while adjustments of one's problems? What is there about the thought processes that ensures that they will take the right and not the wrong direction, that they will get somewhere?

In the course of everyday experience, one does much poor thinking and sees much of it being done by other people. There is ample evidence of muddled instead of clear thinking, of emotional thinking where reasoned thinking is required, of complacency and absent-mindedness when there is need of thoughtful purpose. There is also, however, plenty of evidence of good thinking; there are many children as well as adults who are wide-awake to problems that confront them, sensitive to their ability to cope with these problems, and vigorous and purposeful in going about their solution. So, though there is evidence of poor thinking and of great differences in ability to do good thinking, there still remains the fact that thinking does tend to get somewhere. In everyday life, our thinking tends to take direction; we find ourselves setting and working toward goals. In general, we are sensitive to whether or not we are working in the right direction; we know when our work is done, when we have reached our goal. Perhaps the shortcomings that are many times in

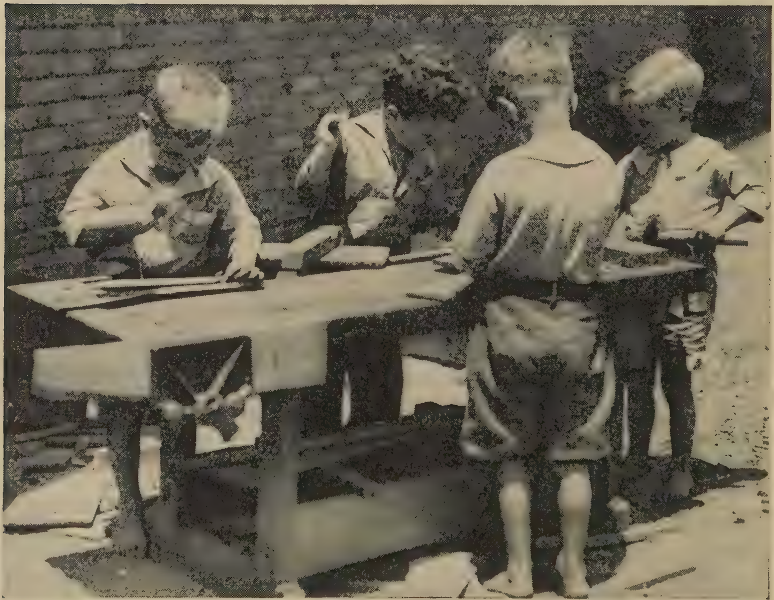
evidence stand out because there is much good thinking, because the expected thing is for people to think through their problems. In any case, we greatly need to understand how thought and learning take direction, how goals are set and progress is made in the solution of problems.

Developing Ability for Directing Experience.—In the closing pages of the last chapter, it was suggested that life purposes, interests, attitudes, and the higher orders of habits are the means through which we maintain control over the details of behavior. These higher orders of habits may be thought of as giving direction to the main current of life and thus determining the direction of the lesser currents that are incorporated in the total stream of experience. Such an interpretation seems sound. It certainly is in accord with everyday adult experience in which we find specific habits and skills used at the right time and in an appropriate manner to meet our needs. There arises, however, the question of what controls the life of the growing infant and child before these life purposes and interests have developed. These higher orders of habits are products of earlier learning; they have become organized through thoughtful organization of experience, and one is therefore left facing the question of how the stream of experience was given direction before these habits were formed.

Jimmie's baby brother does not do much toward figuring things out ahead of time. He seems usually to act first and think afterward. Jimmie, when he got the jam from the cupboard, did not take long to make his plan; it came to him like a flash. He did not think about getting down from the cupboard until too late. If he had weighed matters before acting, he might have known that he could not have got down from that ledge. As he grows older, he learns to judge better the things that he can and cannot do, but of course he is always trying himself out on new things, succeeding in some and failing in others. Thus, his notions of what he can and cannot do are forever changing. In other words, he is getting to know himself better and better.

Even at ten, Jimmie does many things without much planning, and he fails in many of these because, as his mother says, "He doesn't put on his thinking cap." He has found that his playmates have a pretty good idea of what he can and cannot do, and he does not like to have one of them tell him not to "make a fool of himself." In turn, he judges them, too. They all are becoming better judges of themselves and of others. All of this indicates that as their ability to control their behavior develops they are becoming better acquainted with themselves.

Our Problems Are Ours.—The concept of self plays an important part in this development. Thinking is adapting to circumstances consciously. It is the way we establish relations between ourselves and outer circumstances—by creating a plan of action on the conscious level. Good thinking helps us to look ahead and figure things out before they happen. Sometimes, however, one must act and think at the same time, and sometimes it seems necessary to act before we think. However this may be, thinking is at all times a patterning of behavior with reference to some problem that is before *us*, some problem that *we* must do something about. At times, thinking may be well done, at times poorly done; but at all times, it is done to bring *our* behavior into working relation with the situation presented so that some problem may be solved, some disturbing occurrence may cease to exert a stress upon us. The content of the thought pattern is drawn both from the sensory presentations aroused by the immediate situation and from the presentations based on our past experience. In the changing pattern, there are many different elements that represent many different phases of experience, but one element always remains—always, in the thought pattern, we, *ourselves*, will be represented. These representations of self may be in the foreground and dominant in the pattern, or they may be more or less in the background, but in one form or another they are found as an integral part of all our thinking.



(Courtesy of Los Angeles Public Schools.)

For Children and for Youth, Purposes Unite Planning, Thinking, and Doing into Effective Experiences.

Looking at Our Everyday Selves.—Looking at our experience in a sensible, matter-of-fact manner it should not seem strange to find self entering into all our thinking. It is a matter of common experience that we do think of ourselves, and think of ourselves quite objectively at times. We speak of "adjusting ourselves to situations," and of "adjusting matters to suit ourselves." We pride ourselves on having done some things well and blame ourselves for doing some things poorly. Where should we expect presentations of self if not in connection with thinking about problems that involve us? As a matter of fact, a problem is not a problem until it does concern us in one way or another. It is of course equally true that our problems are concerned with other people or with things of the outer world.

The solving of problems by thinking things through for ourselves parallels the process of adaptation on the growth level. It is the same old story of adjustment between organism and environment, now raised to the level of conscious adaptation. In the thought processes, the organism is represented by the concept of self, and the environment is represented by the sensory presentations of the situation confronting us. The situation is interpreted, of course, in terms of our past experience and habits of thought. In thinking, the concepts represent in their very nature the relations between self and environment which have been worked out and generalized from past experience. Thinking may at times seem removed from the actualities of life, but it can hardly be far removed when every element in it has arisen out of the experiences that related us to the world about us. Not only is thought related to reality through concepts that represent past experience, but our thinking is continuously held accountable by the practical situations represented by our problems. Jimmie's notion of getting the jam ran ahead of the reality of action. But his conceiving the climb to the cupboard had behind it very real hunger and very real jam; he dealt with real chairs and real climbing, and he ended

by facing a reality of being too high up to get himself down. Self, and environment, and the relations of the two in the experience of the past and in the situation immediately presented—these are the elements, patterned in thought, which give direction to the solving of problems. It is plain that we are in need of a thorough understanding of how the concept of self develops and how it is related to other concepts.

Early Undifferentiated Experience Is Self-centered.—In the undifferentiated experience of early life the inner and outer aspects of experience are so blended that the child is conscious neither of the outside world nor of himself. Though the baby does not know himself as an individual, he most certainly behaves like one. He responds to the ups and downs of life with smiles and tears and complacent indifference that leave little question of who it is that is happy or injured. When the outside world does begin to take on meaning, this meaning is his. His cry on dropping a toy indicates that something has been lost to him. The time soon comes when his language gives evidence of this personal reference of experience, for his verbal demands center in self and reach outward from self to the outside world. He wants this and he wants that; he does not like this and he is provoked at that. It is natural and inevitable that in this undifferentiated experience at the beginning of life, he is bound intimately into the experience. As he becomes aware of self, he becomes better able to make intelligent adjustments of himself to the world of people and things about him.

The Development of the Concept of Self.—The development of the concept of self has its beginning in dawning consciousness, in the commonplaces of the baby's life, such as watching his fingers which he sees moving and which he feels as they move. These fingers come to be *his* fingers, and presently he is aware that it is *he* who reaches and grasps objects with which he previously came in contact only through random movements. Gradually, it is an

accepted part of his experience to be aware that it is he who puts his hand out to such objects; he grasps, he gets the feel of them in *his* hand, and he responds with a smile that bespeaks some degree of intelligent appreciation of his success. Thus, he gradually becomes the arbiter of his own experience; he comes to know that *he* is somebody in a world of other people, doing things that they do. As he becomes conscious of that world of things and people, he becomes conscious of himself and conscious that his contacts with the world are *his*.

The play life of children reveals significant and interesting developments of the concept of self. For example, a child finds great fun in the game of "peekaboo," a wonderful game indeed through which to become more fully acquainted with the newly dawning self. He discovers that by moving himself behind a chair he can cut off the vision of his mother, and that the same result may be accomplished by putting his hands before his eyes. The fun in the game seems to center in his conscious control of himself and his environment through his own purposive actions. In other words, he does things with himself; he treats himself objectively. Note the further exploration of his powers as the sense of hearing is brought into the play, for if the game comes up to its full possibilities, the mother at appropriate times must say, "Peekaboo!" or "Where is baby?" Through this introduction of the sound aspect of experience, he has an additional plaything, making it possible for him to set his seeing experience over against his hearing experience. The chair or his hands interrupt the visual experience, and the sound of his mother's voice comes to him in spite of the chair or his hands before his eyes. Variations in this game are explored when he puts his hands over his ears to interrupt the sound while he looks intently at its source. In such play experiences as these, we find evidence of the gradual development of the child's consciousness of self, segregated in experience along with his developing understanding of the objective world.

Relational Factors in Conscious Experience.—As the child becomes aware of self and of the world about him, there is also a third factor at the heart of these experiences, the relations that are inherent in contacts with the outside world. In the stream of experience, the individual and other people and things do not move as isolated puppets but are dynamic and interactive factors in the drama of life. As self and people and objects become segregated in the conscious experience of the child, these

(*Courtesy of Pasadena Public Schools.*)
Everything Seems Different When You Get Up on a Fence.

relational aspects begin to segregate also. As the concepts of self and the outside world begin to take form, the concepts of relations begin likewise to take form. The child becomes aware of relations of time and place and cause and effect which have been integral aspects of his early experience, even though he has not been aware of them. He now becomes aware of his mother being *over there*, with the chair *between*, while he is *here*. He must peek *from behind* the chair *in order that* he may see his mother. The sight of his mother comes after he peeks out, and it comes because he peeks out. He cannot see through or

around the chair, but he can hear through or around it. He begins to sense himself as an active and causal agent in events, and he begins to sense other people as acting upon things and things as acting upon him. He senses chairs which he tries to push as resisting him; he sometimes gets angry with them, pushes them over, and calls them names. When people come at his cry to pick up a toy, he seems to become more conscious of the factors involved; we may find him playing with the situation by waiting till his mother has left him and then deliberately throwing the toy on the floor, apparently for the purpose of seeing things happen all over again in the same sequence. These relations exist in the experience of the child. They represent the realities of contacts between people and things, and people and people, and things and things. They naturally become differentiated realities of his conscious life. His play activities are a verification of the significance of these concepts of relations.

Relations Evidenced in Language.—As we have noted in our study of language, it may be difficult for a child to give verbal definitions of the meaning of relational concepts, but they are nonetheless real to him. The continuous and varied use of words and phrases to express these relations is evidence that these forms are related definitely to experience. A child would not use the language symbols of relations if they had no meaning, and their varied use indicates that they have, to some degree at least, become differentiated concepts. In his first language expressions, a child may put the meaning of a whole sentence into a single word. For example, *up* may be a demand that his mother lift him from the floor to her lap. When he learns other words to express this thought, *up* will be used in different situations and with greater discrimination. The ups and downs, the befores and afters, the yours and mine, the becauses and ifs, and the whys and hows, which exist between him and the world about him, come to have their own differentiated meaning.

As the relational concepts are segregated from experience and acquire meaning of their own, it is always implied that these relations hold between something or other. Naturally, the early concepts of relations are thought of by the child as being between himself and other people and things. In like manner, as the concepts of things such as tables and chairs develop, the relational factors are implied in these concepts. The table in early life is the thing we eat on. As the concept of self develops, the objective world as an essential of experience is implied in the concept. The child thinks of himself and of other people as eating at tables. He understands himself as the person who plays "peekaboo" with his mother and other people. To state the matter briefly, the undifferentiated experience is essentially relational, and the concept of self develops as a person relationally disposed toward the outside world. Concepts of the objective world are likewise relationally organized with reference to him. These relational dispositions of self to the objective world we call *attitudes*.

Attitudes in Adult Experience.—It is not difficult for adults to discover that they have attitudes toward the larger affairs of their lives, but the attitudes that are inherent in the lesser incidents may not be so apparent. An examination of our experience will show, however, that we project ourselves into all kinds of situations presented by the outside world. Indeed, there is no conscious experience that does not have this personal and relational aspect. For example, the reader may find himself relationally disposed in a variety of ways to the book he is reading. It is sensed as being near or far away for convenience of vision; if held in the hands, the effort used to support it is felt as directed from the reader to the book, while the book pulls against this effort and the reader's effort is directed against the pull of the book. The relational aspect is there as a factor in experience even before it is recognized through being called to the reader's attention. In other words, this

relational aspect of self in experience is an integral part of sensory presentations.

This basic relational aspect of self can be discerned in a wide variety of experiences. We go to see a ball game with all sorts of sets toward the teams that are to play, toward the umpires, toward particular players. Such attitudes may be fairly well established; they persist from one game to another and tend to influence our reactions to the particular incidents of the game. For example, as we watch the game you and I have our own particular "feel" about the way the pitcher "winds up," the way the bat cracks when the ball is hit, the way the ball sails out into the outfield, the way it goes over the fence and drops out of sight. The point is that at all times we find ourselves in dynamic relation to such circumstances. We are definitely disposed to the slow preparation of the pitcher before throwing, to the speed of the ball as it comes to the batter, to the crack of the bat which fairly comes at us. We see these personal dispositions more plainly revealed in those tense occasions when a hit or close play at a base brings the spectators to their feet, a part of the action on the field as they open their mouths and give vent to their feelings. Players in turn sense their relations to the crowd. How odd to us seem the people who have remained quiescent in their seats at such moments! They have, as they often say, "come out to be with the crowd." We who give ourselves to the game wonder how they can be a part of the crowd and be so little a part of the game.

Such incidents are, in their essential relations of time, place, cause, and effect, no different from thousands of others that go to make up our lives. Some of our work, like some of our games, we like better than others. Every incident in such work and play takes its setting from the relation that we bear to it and that it bears to us.

Self in Sensory Presentations.—Self takes an active part in the things we do. If not in the foreground, it is in the background of all our experience. The root of this whole

matter of self in experience is found in the fact that all sensory presentations are two-sided affairs; they involve stimuli both from the outside world and from the internal organism. Although the presentations may appear to be of the outside world, they are at the same time of ourselves. Let us see just what this statement means in terms of conscious experience.

In another chapter, it was shown that the organism does not receive the stimuli of the outside world passively. The reception of stimuli is an active matter, involving motor adjustments of sensory organs to prepare them for the receipt of the stimuli. These motor adjustments set up a host of stimuli from the sense organs in muscles, joints, tendons, and organs of balance, all of which are concerned with the adjustment of the body for the best receipt of stimuli from without. Thus, our firsthand acquaintance with the outside world is seen to be two-sided, involving stimulation both from within and from without. This dual aspect of sensory presentation becomes readily apparent as we strain eyes to see some distant object, sniff the air to catch some elusive odor, explore with the tongue the food in the mouth to get the taste, bend the head and cup a hand to the ear to catch a faint sound more clearly, or run hands over a surface to feel its smoothness. These definite inner participations in sensory presentations of the outside world are supplemented by the stream of excitations to and from the viscera, which, as we have learned in still another chapter, have much to do with the emotional content of our experience. It is this two-sided aspect of experience that unmistakably connects the sinking feeling in the pit of the stomach with the crack of the bat and with the ball as it goes out of sight over the fence for a home run. The ball sailing over the fence seems freighted with our attitudes. We give expression to the personal element by exclaiming, "There goes our ball game!" That feeling in the pit of our stomach is without mistake concerned with that ball.

These facts which we are at such pains to make definitely apparent are accepted by everybody in everyday living. Pushing a lawn mower may be conceived as an abstraction by a psychologist, but to the man of the house it is putting himself behind the machine and pushing. When he tells you the next day that he mowed the lawn the evening before, the relation of the mower and the resisting grass is a very real part of the mental content. We commonly speak of making our way about in the dark. Later, thinking the matter over, we may decide that dark is nothing to make one's way in since it is not tangible and can offer no resistance. As experience, however, the dark sometimes reaches at us and menaces; at other times, it cloaks us, and we sink into it peacefully. Sometimes we go whistling through a foggy, drizzling darkness with a sense of companionship with it, but at other times we try to shrink within ourselves to get away from it. Such immediacy of relations is found in the understanding some people have of the wide reach of prairies and in the fear other people have of mountains or the sea.

Attitudes Are Directive Factors in Mental Activity.—Naturally, the relations of self to the world about us influence the direction of our thought. The various sensory presentations and the representations of concepts which make up the thought processes are always changing in their relation to one another and in their influence upon the thought pattern as a whole. The pattern is dynamic; a presentation may at one time be in a position of dominance in the pattern and at another time be quite obscured by the dominance of other presentations. Let us note, however, that even though a presentation may not occupy a central place in consciousness, it may still exercise some degree of control. The push and pull, the leading and intriguing of our thinking, represent the inherent push and pull of our concepts as they act on each other. As the stream of experience moves forward, the presentations of the moment may still be potent in the pattern of the next few minutes or of a

longer time, even though they are succeeded by new vivid presentations that occupy the center of attention. Examples of this continued influence are at hand at all times. We may cite again the incidents of the motorbus or the dripping water, previously described, which came upstage in the conscious pattern because they served so well as examples. Once given recognition, they were in the spotlight of attention; but in due time they gave way to the more vital and permanent interest of writing. Now, as you see, they have repeated the performance of coming upstage, and again they retire as we proceed with our larger purpose.

This continuity of influence arises naturally from the fact that every element in experience is in its very nature disposed relationally to other elements and to the whole of experience. Thus, the problem of how thought and experience gain direction and hold direction is answered when we realize that every experience is relational and dynamic in nature. One cannot think of breathing except in relation to air and to the needs of tissues. The pupillary reflex has no significance except as it is considered in relation to sensitive nerves of the retina and the changing intensity of light. In the same manner, sensory presentations join the learner and the objective world in relations that are dynamic and interacting. The concepts that develop from these contacts are patterned with these dynamics and relations as an integral part of them. It is utterly impossible to think of ourselves without the accompanying aspect of dynamic relations, which we call *attitudes*. So too, we cannot think of the objective world without thinking of it in its relation to us. The very fabric of such concepts is built out of the consistencies that have meant something in our experiences. The fact that we create these concepts out of experience should be conclusive proof that we are vitally a part of them. This being the case, the problem of direction in thought and experience becomes resolved. Our understanding of attitudes becomes broadened and better organized as we study the patterns that we call *interests*, in

which we find *ourselves* and selected concepts of the outer world built into dynamic systems that wield strong influences upon our thought and action.

The Persistent Influence of Interests.—The motorbus, of which we spoke earlier, may have been interesting in itself, and the dripping water may have been persistent in its incessant dripping, but they gave way to the more thoroughly organized interest of the author in writing. The writing had the advantage of maturity in which a far-reaching and well-knit pattern had been established. In such interests, self is a dominant member. In them, self is organized in relation to a well-knit pattern that represents some broad field of experience. The reader has but to review a half dozen of his own interests to find both himself and the well-organized fields, with the two in intimate and vital relation. Jimmie is interested in railroading, a natural consequent of rich and vital experience. His companions may have dominant interests in other fields, in keeping with their experience. These interests may change—some will surely change—but for the time being they represent the broader highways of experience that are so well traveled that thought and action readily follow them. Thus, they tend to determine the direction and at times even the destination of the thought processes.

Interests Are Our Own.—When we compare the interests of individuals, we find that they vary greatly. Your interests and mine are organized about *our* concepts. Even when we use the same name for an interest, we may find that the interest itself is by no means the same. For example, I may be interested in nature and so may you, but when we come to compare these interests we may find them to be so different that the two cannot well be given the same name. We may find that we are both interested in elm trees, and we may find that our interests are both centered in those wonderful, upreaching limbs which support the great, umbrellalike tops of these trees. To me, however, the elm and its upreaching limbs are part of a scientific interest,

which leads me to be much concerned about the biological phenomenon of branches and leaves reaching toward sunlight; you, on the other hand, are interested in the artistic in nature and are therefore intrigued with the symmetry and unity that these limbs give to the shape of the elm tree.

We Sense the Strength of Our Interests.—It is common experience to find people evaluating the strength of interests. We ask a friend if he is interested in this, that, or another thing; and immediately and very definitely he replies that he is greatly interested in this, that he is but moderately interested in that, and that he has no interest at all in the other. Interests of childhood disappear, and new ones take their place. Sometimes, to be sure, interests persist and hold a very definite unity of their own, as we see in some of our hobbies. We begin to collect stamps when very young, and the hobby remains an absorbing interest throughout life. Instead of collecting stamps, others of us find pleasure in driving an automobile, or playing golf, or reading detective stories. These hobbies seem to have acquired a special place in our lives, as we see from the manner in which we set aside the cares and worries and other interests of the day and find recreation in one of the activities that engages us so fully and so enjoyably.

Measurement of Interests.—When we attempt the measurement of interests a difficult problem confronts us, (1) because the variability in the interests of one person as compared with others makes it difficult to determine just what is to be measured and (2) because some interests seem to be so short-lived in a given individual that what might be measured today would be greatly changed tomorrow. It was perhaps the difficulty of identifying particular interests applicable to many people that prompted Wyman[1] to attempt the measurement of but three general

[1] Terman, Lewis M., and others, *Genetic Studies of Genius*, Vol. 1, pp. 455 *ff.*, Stanford University Press, 1925.

(Courtesy of Los Angeles Public Schools.)

(Courtesy of Los Angeles Public Schools.)

(Courtesy of H. P. Lewis.)

(Courtesy of Los Angeles Public Schools.)

(Courtesy of F. E. Ostrander.)

Interests Are as Varied as the People Who Have Them.

aspects of interests, namely, the intellectual, the social, and that centering in activity. The effort to evaluate these three aspects of interest seems very reasonable, for we find many of our friends who seem to be persistently concerned with pursuits that are dominantly one or the other of these types.

The Wyman test is a free-association test; that is, one after another of a list of words is pronounced, and the subject responds immediately with the first word that comes to him. In the making of the tests, the different responses to a given word were each evaluated in terms of the intellectual, social, and activity aspects of interest. This evaluating of responses for intellectual interest, for example, was based on the difference in the responses of two groups of children, one group being chosen because they were judged by their teachers to be very high in interests along intellectual lines and the other group being chosen because they were judged to be low in interests of an intellectual nature. Two other groups were chosen to represent the two extremes of social interests, and a third pair of groups represented the two extremes of activity interests. If the high-interest individuals of these groups gave a certain response word more frequently than the low-interest individuals, this fact became the basis for evaluating the word's potency for revealing this particular type of interest. A given response received different values for the three types of interests because of the differences in the frequency of its use by the different groups. Scales of values ranging from 0 to 20 were used to show the relative significance of a response for the three different aspects of interest. For example, when the stimulus word *gem* is pronounced, the response *diamond* is scored 20 for intellectual interest, 11 for social interest, and 15 for activity interest. Other responses to the same stimulus word *gem* receive different evaluations, *ring* being scored 9 for intellectual, 13 for social, and 5 for activity interest; the response *exercise* gets the heaviest scoring for activity

interest, it being scored 3 for intellectual, 9 for social, and 12 for activity. We may find it difficult to comprehend why some of these responses should be indicative of these three aspects of interest, and our confusion in this respec may well be taken as evidence of the variability of what constitutes an interest in one person as compared with another.

The Reliability of Interest Tests.—It is difficult to create interest tests that are reliable, that is, tests that will place an individual on the scale of values so that he will "stay put," instead of being at the top today and when tested tomorrow being found near the middle. When the reliability of the Wyman test is computed by correlating the score on one form of the test with the other form given on the same day, the reliability coefficient is very satisfactory; it compares well with that of achievement and intelligence tests. When there is a separation of 10 days between tests, however, the reliability coefficients are very markedly lowered for intellectual interest and considerably lowered for activity interest, whereas the social-interest scores remain fairly stable.[1]

When we remeasure interest in the same individual after a lapse of several years, the change in interests is shown to be quite marked. Many studies have shown that we change in our interests with growth and experience. The younger we are, the more marked are these changes. As we grow older, we tend to settle down, but we nevertheless continue to change and become something of a different person. This general change is, of course, reflected in the change in our interests. Several groups of children of different ages were retested on the Wyman test after a period of 5 years,[2] and it was found that the individuals had changed in interest ratings. This fact is the more interesting when we note that for the most part the average scores for the groups of different ages (from eight to fifteen

[1] *Ibid.*, pp. 467 *ff.*

[2] *Ibid.*, Vol. 3, pp. 129 *ff.*

years at the time of the first test) remained much the same after 5 years. In other words, none of the three types of interests had, in general, grown stronger during the 5 years of life. Though group averages remained fairly constant, the scores of individuals shifted, the place of one individual being taken by another and this individual in turn taking a different place on the scale. The averages indicate that the youngsters are as a group the same, but judged by the shifts in the three aspects of interest as here measured the individuals are not the same youngsters.

It seems very reasonable that a person should respond to the word *grand* with one word today and another tomorrow; the different responses might arise out of the different sets which he has toward life on the two days. We are to a considerable degree the same person from day to day, but the world may look quite different to us today from what it did yesterday. It seems that when we are dealing with interests we are dealing with an aspect of human nature that is quite changeable. Although the changes recorded by interest tests may be due in part to the limitations of test making, they undoubtedly reflect in part the changes in the attitudes of individuals and the way interests change in their relation to the larger purposes of life.

Analysis of Vocational Interests.—It is the common opinion that many people choose lifework which is not suited to them. Any means which would aid in this problem of guidance of youth into vocations that are suited to their fundamental natures, to their interests, and to the circumstances of their lives, are to be highly prized. Much effort has been given to developing the techniques of vocational guidance, but some of the checks that have been made on the use of such guidance in placing youth in vocations are not encouraging.[1]

[1] Lorge, Irving, "The Chimera of Vocational Guidance," *Teachers College Record*, Vol. 35, p. 359, February, 1934. See also Kitson, H. D., "Vocational Guidance Is Not Fortune Telling," *ibid.*, p. 372.

One method of measuring vocational interests that seems to hold some promise is that of constructing an analysis sheet or blank for revealing attitudes toward professional fields. Cowdery[1] used a modification of the Carnegie Institution of Technology interest-analysis blank to reveal attitudes toward the professions of medicine, law, and engineering. He chose people who were highly successful in these respective professions and used the difference in their responses as compared with those of other groups as the basis for evaluating the separate items on the blank.

Fat men	*L D O*	Football	*L D O*
Thin women	*L D O*	Physics	*L D O*
Poet	*L D O*	Sociology	*L D O*
Nurse	*L D O*	*Life*	*L D O*
Dancing	*L D O*	*New Republic*	*L D O*

SAMPLE ITEMS FROM AN INTEREST INVENTORY

Mark each item: *L* if you like it, *D* if you dislike it; *O* if undecided or know nothing about it.

The separate items on the blank were single words or short phrases, 84 of which referred to occupations, 78 to types of people, 34 to sports and amusements, 6 to pets, 13 to different kinds of reading, 23 to miscellaneous activities, and 25 to school subjects. The person filling out the blank gave one of three responses to each item in the test, indicating his attitude toward the thing named as one of liking, indifference, or dislike. Values of responses to each item were determined for each of the three professions in somewhat the same manner as Wyman determined values for the items in her interest test.

Having taken the test, one's responses are given values for each profession, and when these respective values are summed they give an index of attitude toward each of the three professions. The test results definitely differentiated between 80 and 90 per cent of the members of a profession from nonmembers. About 70 per cent of high-

[1] Cowdery, Karl M., "Measurement of Professional Attitudes," *Journal of Personnel Research*, Vol. 5, pp. 131–141, 1926–1927; "The Interest Inventory—College Vocational Guidance," *Psychological Clinic*, Vol. 19, pp. 59–62, 1930.

school seniors who came from the better types of homes where professional choices might be expected, showed definite classification in one of the three groups. The results of the interest blank show little correlation with intelligence scores, and the results do not seem to be affected by added study in the professions. There is a definite, though not large, correlation with college grades in subjects related to these professions.

Cowdery's study indicated that, in such fields as the three professions here studied, interests can be differentiated through the evaluation of responses to a large number of stimulus words. Such fields of interest represent the life purpose of the individuals measured. One does not usually enter upon the preparation for one of these professions without much planning and serious concern. These are exactly the conditions that are essential to the formation of a stable interest, namely, a broad, well-integrated field of knowledge, closely related to the dominant purposes in the life of the individual.

Such interests as these are sufficiently comprehensive and stabilized in their relations to life purpose so that they become significant aspects of an individual's personality. At times, we hear such statements as "I live for my profession" or "My work is my life." Such statements tend to reveal the extent to which some basic interest may involve the whole personality of the individual. More often, we hear of people who divide their time and energy in keeping with their interests in several different fields. We hear such a person say, "My work, my home, politics, gardening, a few close friends, golf twice a week, church on Sundays—that is my life." Many times also, we find the person who adds to these usual fields of interests several other activities, clubs, community organizations, and offices of various kinds that contest for every minute of time. In such a survey of personality through interests, we see human nature living essentially an organized life, with the self built into the various relations of work and play

and responsibilities to home and community groups. Such interrelated interests make an individual the person that he is. Thus it is that attitudes toward the smaller incidents and things of living become organized into the main currents of the stream of life. New problems that confront us meet an organized front of interests and habits and attitudes which are strong factors in giving direction and purpose to thought and learning.

Persistence of Interests Compared with Persistence of Other Abilities and Achievements.—We say that interests are relatively changeable, that they change with experience, that they change with the changing personality. We get a better perspective upon the changes in interests when we compare their persistency with that of other characteristics and abilities. Weight and height are relatively stable factors in individuals. On the whole, the boys that are at the top of the group in weight at eight years of age will be at the top of the group at fifteen years of age, and those that are tallest will tend to remain the tallest of the group. The girls may on the whole be much better looking at fifteen than at eight, but when one girl is compared with another they tend to retain those essentials of appearance in color of eyes, texture of hair and skin, and fineness and outline of features which give them their place in the group. Even these relatively stable physical characteristics are of course subject to some variation.

In a later chapter in which we consider the measurement of intelligence,[1] we shall find that what has been called *general intelligence* remains fairly constant. To state this in another way, we might better say that the intellectual development of individuals is fairly constant, so that if they develop unusually fast in early years we may expect them to continue this rate in later years of childhood. Those at the top of a group of children of the same age tend to remain at the top, and those at the bottom to remain at the bottom. But here again variations from the

[1] See Chap. XIV.

general rule are to be noted. Studies of identical twins[1] who have been separated in early life reveal that some of the pairs maintain much the same rate of development, whereas other pairs quite markedly show the effect of difference in experiences that have arisen from differences in their environment.

We might well expect to find variations in measures of achievements of an individual to be even greater than in measures of his intelligence. Occasion will be found later for citing Kelley's findings that a comprehensive test of achievement involves to the extent of 90 per cent the same factors measured by an intelligence test. What we learn tends to be stabilized in accord with our ability to learn. We can all bear witness, however, to the fact that our achievements in different years of our lives have been conditioned by facts other than our intellectual ability. The influence of particular teachers upon our effort is undoubtedly great. Illness and discouragement may influence achievement in one direction, and good health and high purpose may change the picture after a few weeks' time.

Given normal conditions of right food and care, weight and height and appearance may show little response to other circumstances; intelligence quotients may remain relatively constant; but achievement in different subjects is undoubtedly somewhat more responsive to changing conditions of life. Even more definitely can we bear witness to changes in interests through the influence of people and of circumstances. Still more definitely do we assert, on the basis of our common experience, that our attitudes toward particular people and things have been changed many times by single incidents. Strange, is it not, that as we come to consider these less defined and more elusive

[1] Jennings, H. S., *The Biological Basis of Human Nature*, p. 166, W. W. Norton & Company, Inc., 1930.

Freeman, Frank S., *Individual Differences*, pp. 105 *ff.*, Henry Holt & Company, Inc., 1934.

factors of behavior we seem to be getting closer to what we recognize as our personal selves!

For our present purposes, we are particularly concerned with understanding the relatively permanent and well-organized fields of interest as they play their part in the organization and control of the thought patterns through which we solve our problems. The crux of this matter lies in the fact that interests include representations of self that are rich in well-established attitudes. These patterns have the advantage over other patterns in being well organized. They represent past experience that has gained potency in being thus organized and in being vitally related to self.

Right Direction in Learning.—To the question of how thought takes right direction, one might reply with another question: How does any behavior take the right direction? Blinking the eyelids to remove dust from the eyeball is behavior in the right direction. It is right because irritation is stopped and conditions for seeing are improved. Our rate of breathing increases when we begin to run; the behavior changes in the right direction—more air is supplied to the lungs and thus more oxygen to tissues. If the change is not adequate to the demands in such cases, we soon know about it; it becomes painful to continue running, and, if pushed to the extreme, we fall exhausted. So it is in the more intelligent aspects of life. We plan the day's work to get certain things done so that tomorrow we may be able to do certain other things. If the planning proves effective in meeting the situation, we say that thought and action were right. If they were not right, we know it because of the pain and dissatisfaction connected with more work and more planning and because we will have less of the things that we desire. We are continuously presented with situations that raise problems; right direction means that adaptations are made which resolve the tensions and stresses that arise in the course of such experience. As applied to thought processes, the resolving of these tensions

can be nothing more than the evolving of a more meaningful and consistent thought pattern. At times, we see through our problems immediately and are ready to proceed with necessary adjustments to the situation. The boy who solves the problem on which he is intent exclaims, "I have it," and thereby gives evidence of a stress being resolved, of progress made in the right direction.

A Common-sense View of Insight.—*Insight* is the name we apply to such patterning of the thought processes or to any progressive change in intelligent behavior leading to adaptation. The patterning of sensory presentations in the early life of the babe is insight; it gives the rudiments of meaning; it is the beginning of understanding. Insight means just what people of all walks of life take it to mean: it is growth in understanding. When we begin to see through a problem we call that *seeing through*, insight. Any change in the pattern of intelligent behavior that furthers the resolving of stress may rightly be called insight.

Obviously, there are many levels of insight. Some situations are so beyond our present level of ability that we may be quite unaware of the problems they hold for us. If such a situation means nothing to us, we naturally do not change our behavior intelligently; there is little or no insight in such an experience. We find ourselves in other situations that are presented to us as problems but that seem beyond our ability to solve; we have only enough insight and understanding to recognize something of the nature of the problem and something of its difficulty. Such recognition of a problem is evidence of some degree, sometimes of a high degree, of insight. In other situations, we see the problem, we get some measure of understanding of its difficulty, we evolve a method of attack, and we then proceed with its solution. Some problems challenge our full capacity and ability for making intelligent adaptations; others are quickly interpreted in the light of past experience and present little difficulty. In all these situations, we sense the relation of self to the situation; it is *our*

problem, the situation confronts *us*, *we* make an attack upon this problem that is *our own*. Problems are not apt to be solved unless this personal element is involved. This is the general everyday view of insight. It remains to reveal more of the way it operates and thus come to a better understanding of it.

If we examine Jimmie's exploit of getting jam from the cupboard, we find that there are many levels of insight implied in the different phases of this enterprise. Some insight is implied in Jimmie's spying the jam on the shelf; it is recognized and has meaning to him. We do not think of insight in connection with just being hungry, but there is insight involved in our intelligent efforts to satisfy hunger. Note, too, that Jimmie is more than just hungry; he has an appetite for jam. An appetite for certain food implies understanding, implies a patterning of behavior that partakes of some degree of intelligent discrimination. There is insight in Jimmie's recognition that the jam is too high to be reached from the floor and likewise in seeing the chair as the means by which he can climb to the shelf; there is insight implied in his recognition that he is able to do something about the situation. In brief, the situation is sized up, the plan is instantly conceived, and swift action follows as chair is pushed to cupboard and boy climbs on chair and thence to the ledge of the cupboard. Through these intervening relations of boy and chair and cupboard, Jimmie reaches the jam.

Insight, the development of understanding, is present in every step of the enterprise and in the enterprise as a whole. Every step in the behavior is sensed as right, sensed as a fitting part of a behavior that is consistent with the goal in view. This sense of right direction is evidence of insight on the conscious level. Jimmie, however, solves one problem only to be confronted with another as he finds himself marooned on the ledge of the cupboard; but there is insight in his distrust of his ability to get down by the route taken to get up. The problem of climbing down

presents the possibilities of another worthy adventure; but the pattern does not form on the same high level, and he resorts to a lower and less worthy level of insight as he calls to his mother to get him out of his difficulty.

Insight as Consistencies in Thought Pattern.—The thought pattern must be consistent within itself, or successful action cannot be expected to follow. Jimmie's success in getting the jam implies that he conceived himself as being able to push the chair, do the climbing, reach the jam, and, of course, eat it. The chair is conceived as something that can be pushed and climbed upon. Much of past experience is implied, and much of organization of this experience into working concepts is likewise implied, in the venture. If the chair proves to be too heavy, or if a rough floor halts the sliding of it to the cupboard, or if Jimmie finds his reach too short, then thought is proved wrong, and plans must be revised to meet the new situation. The conscious experiencing of right direction and wrong direction in conceiving the plan rests upon the consistencies of related concepts, such as evaluation of the weight of the chair, of Jimmie's ability to push it, of the character of the floor, of Jimmie's ability to climb, and of the stairs made by the chair and cupboard ledge. If sensory presentations of the changing outside situation are not consistent with concepts as they are organized in the thought pattern, the plan is halted both in thought and in action.

Every factor that enters into such experience is dynamic; it is disposed toward the establishing of these relations in the thought pattern. Change the situation, and a different pattern of behavior is called for; change the person to whom the situation is presented, and the resulting pattern is, of course, different. Jimmie responds differently to jam before a meal than he does after a meal. There was a time when jam meant nothing to him. There was a time when the pushing of chairs meant nothing to him. There was a time when his physical capacities were not enough developed so that he could have got the jam even if he had

seen the possibility of doing so. Jimmie in those earlier days had not come to see himself in relation to jam and chairs and pushing and climbing in a manner that would have made possible the patterning of these individuated parts of experience into the jam-getting exploit. But Jimmie grew older, these relations became established and organized through experience, and now the pattern was formed under the stimulus of the situation; in thought, Jimmie conceived himself getting jam, and in the reality of action Jimmie got the jam.

Insight Inherent in All Aspects of Intelligent Behavior.—No learning situation exists that does not constitute an example of insight. Learning is a broad term that covers any adaptation to the new and novel. Learning leads to increased understanding through developing insight. The babe who learned to find the candy by choosing a box of a particular shade, the chimpanzees that learned to choose the right box, and the chickens and the goldfish that learned under somewhat similar circumstances—all these underwent experiences that involved insight and led to increased understanding.[1] Although these examples were first introduced to show the nature of the most elementary sensory presentation, they are at the same time excellent examples of insight and learning of a basic order. The beginnings of meaning and the rudiments of understanding arise in the patterning that accompanies these basic learnings; in these situations, there is a correspondingly basic order of insight.

A very high order of insight is to be found in the complicated patterning of experience represented by the French mathematician's finding the four mathematical functions. These were formed in unusual situations and apparently with little effort, but they represented the results of a lifetime of study and organization of concepts and thought patterns on which they were based. Insight is shown in the experience of the sales manager who had misquoted

[1] See Chap. VIII.

prices during the day and wakened in the middle of the night aware of his error.[1] Both these examples, of mathematician and salesman, show the operation of insight in the process of maturation. The basis for the formation or reformation of patterns had been laid in past experience, the problems were of interest to the learner, and the conditions were right for the pattern to form ultimately, even when the salesman was asleep and when the mathematician was intent on other matters. We commonly think of intelligent adaptations and insight as involving conscious thinking, but the evidence shows that learning and insight include phases of adaptation of which we are not aware.

Initial Delay and the Setting Up of Goals.—Learning has been described as a goal activity, and this statement is in line with the facts as we experience them in most of our learning. It does not add greatly to our understanding of learning, however, merely to say that it is a goal activity without finding out how goals originate and how they function in learning. Goals are more or less apparent in much of our intelligent behavior; but, at times, learning may take place when the goals are not easily seen. It may be hard to believe that goldfish[2] in learning to choose the right brightness of light were aware of a goal as such. Their behavior, however, revealed that something in the nature of goals was operative, for when they were put into the tank with the lighted compartments before them they would apparently first size up the situation and then swim straightway for a chosen compartment. The sequence of their behavior was as follows. First came a period of initial delay before they moved toward any compartment; then this was followed by their swimming directly to a compartment in a manner that is characteristic of action that has a definite goal. It seems reasonable to interpret this initial delay as a period in which a pattern of behavior was forming, in which a goal was being set up. The behavior

[1] See Chap. VII.

[2] See Chap. VIII.

that followed was characteristic of behavior that has a goal.

There seems to be ample justification, more fully presented in the next chapter, for interpreting initial delay and the goal-activity character of learning as the outward manifestations of relatively high orders of insight. As we commonly experience this period of initial delay, we find ourselves surveying a situation before us, trying to understand what it is all about. We sense something of what is demanded of us, and presently we set up some sort of goal. This initial pattern may at first be ill defined, and so the goal that arises from this initial patterning may likewise be ill defined. Both the pattern and the goal, judging from much of our common experience, gain in definition as we move forward with the solution of the problem. It is common experience to recognize when the pattern forms, that is, when our thoughts take shape so that we can progress directly and unhaltingly toward the solution of the problem. At times, the pattern forms almost instantly and the goal is apparent. So it was with Jimmie in his jam getting. Jam was seen, the chair observed, and he was off in a definite way to his goal. At times, we do not know definitely what to do when presented with a situation. We may be but hazily aware of the problem; we may be at a loss as to the best action to take; and the period of initial delay is therefore long, and the goal may be correspondingly ill defined.

Purposeful Behavior.—The cause of such delay may be that we are not vitally concerned; the circumstances do not move us in a manner to supply the energy that is essential to the formation of the pattern and the pushing of the issue to a conclusion. At times, we find ourselves suddenly seeing that the matter is vital to our interests; then there is a sudden change in the dynamics that are put behind our effort. In speaking of such experiences, we commonly say that we suddenly became stirred up about the situation, and we rightly interpret this to mean that

the emotional aspect of our natures has become involved. Perhaps we may say that we have put more of ourselves into the experience. The dominance of self in our thoughts is what makes them vital to us, and it is the dominance of self in these problem experiences that makes them vital, that gives them the energy to push them through to a conclusion. As we have seen in another chapter, our emotional nature is rooted in the behavior that is basic to our existence, and our concepts of self, we may be sure, are rooted in the same way in experience that is of basic importance.

In the affairs of everyday life, we interpret this relational aspect of self with a great deal of confidence. We readily understand the differences in effort and continuity of purpose of a ten-year-old girl when she is playing with her dolls and when she is washing dishes for her mother. We understand the energy that youngsters give to the pushing of chairs when they are getting jam. We see these relations of self to the outer situations change as the situations change and understand the moving development of behavior as an expression of purpose. Jimmie's purpose is in keeping with his goal. When he gets the jam, his purpose and his goal change. When he finds himself marooned on the ledge of the cupboard, a new goal arises. He has changed, the outer situation has changed, and these changes are reflected in the direction and energy of his subsequent behavior.

Summary: The Relational Aspects of Experience.— Let us here summarize our understanding of self as it is related to experience, in order that we may better see the part it plays in the direction and control of learning and intelligent behavior.

1. In the undifferentiated experience of early life, babes are not aware of self or of the particular objects of the world about them. Awareness of objects and people, awareness of self, and awareness of the relations between objects and people and self arise as these become segregated from

undifferentiated experience. Out of the first crudely differentiated experience, there arise the beginnings of consciousness of self, consciousness of objects and people, and consciousness of relations between self and objects and people.

2. With continued experience, concepts of self and of the objective world develop, with relational and dynamic aspects inherent in them. Our attitudes are the relational aspects of self; we have attitudes of a more or less definite nature toward everything. Concepts of the objective world of people and things have this relational aspect. If one thing is above, another thing must be below; leaving by one person implies the staying of another. This is true in the reality of experience, and it is true in the concepts that grow out of experience. Concepts of relations, of above and below, of leaving and staying, imply self and people and things in the relations. So it is that in all concepts we find experience organized dynamically, and so it is that concepts enter into the thought processes dynamically and relationally. Like all differentiations, concepts are created, and they are maintained, in dynamic relation to other differentiations and to the larger whole of life. They come from life that has direction and purpose, and they enter into it again to give direction to more living.

3. Concepts become patterned together into larger wholes which we call interests. Like concepts, these interests develop in the stream of experience. They are vitally related to the developing concept of self. More and more, they become organized into fields in which our natural tendencies, our plans, and our ambitions are furthered and find fulfillment. Interests are potent in the thought processes for the same reason that concepts are potent, because they are inherently dynamic and relational in character. Again, like all differentiations, interests gain their individuality and maintain their individuality only in relation to other interests and to the larger pattern of behavior which we call our *selves*, or our *personality*.

Thus we conceive of the relational and dynamic nature of self and of the objective world. Concepts and interests arise out of experience and are organized to enter again into experience. Presented with a situation, we find that our interests conflict at times with the necessities before us; we sometimes must do things we do not want to do. At times, we may find that our interests conflict with each other; there may be so many things which we would like to do that it is difficult to choose which to do. Out of this conflict of interests and necessities, we project our lives, halting the onward movement of experience to sense direction and set goals and organize our energies and insight into purposes so that adequate and fitting adaptations are made to realities. Thought and behavior are built out of the dynamic relations that have characterized past life. Human beings are organized for purposeful living, and they live purposefully.

SUGGESTIONS FOR NOTEBOOK AND BULLETIN BOARD

1. Make a pictorial chart to show the developing interests of children of various ages. A page in your notebook can be given to each of several ages, or it may seem best to develop the chart on large tagboard, with the expanding and changing interests illustrated in areas that represent different ages. Note how these main channels of experience move out from the essentials of life of the young three-year-old child in his firsthand conception of the outside world to the more remote areas of the life of later childhood and youth. In such a display, one has a record of developing intelligence, whether this be thought of as increased capacity to learn or increased capacity to organize experience for effective use. The record shows not only the increase in ability to adjust to the new and novel in life but also the development of concepts and interests for further use, for more learning.

DAIRY OF YOUR OBSERVATIONS

1. Observe a child, eighteen to twenty-four months of age, and note the experiences that are particularly rich in developing

conciousness of self. These will of necessity involve the development of concepts of the objective world and of relations. An example of such an experience was observed when Bradley, who was only beginning to talk, noticed a spot of light that fell on his hand. The light came through a small hole in a window shade. Bradley was not aware of the source; his attention was centered in the spot on his hand, and he tried to close his hand on it. Then he turned to his mother with a look of wonder on his face; apparently, this was a new experience. His mother smiled and said, "Give Mother some," and he turned back to his hand to find that the spot was not there. Presently, he saw where to get it again, and he proceeded to play that he was giving his mother handful after handful of this funny stuff that could be seen but not grasped. All the time, he was laughing and having great fun. At his mother's suggestion, the play was extended, and he took some to his grandmother and came back for more.

This experience is like many others in child life, in which the interrelation of developing concepts of self and of the objective world may be observed. It is an excellent example of the part play activities have in the developing experience. Here we see experience move from the firsthand contact with the objective world to the play life in which the consistencies and inconsistencies of the new experience furnish occasion for the development of new concepts. In such experience, the learner gains new insight into his own abilities; he becomes to himself a person who can do new things; he can play the game of life in a richer way.

In your notes of such observations, indicate the changing phases of the experiences that seem to be dominantly (*a*) of self, (*b*) of the objective world, and (*c*) those that result in concepts of relations between the two. Naturally, the three developing phases of experience are but differentiations; they are rooted in the total experience, and we can interpret them only in relation to the total experience. Every phase, you will note, is inherently dynamic; it is a part of active living and enters again into the thought processes to direct more active living.

2. Through conversation and observation, make interest surveys of several children of different ages. This may well be a

cooperative venture for your class or a study group. It may be possible to cover a wide range of development. The materials may be organized through illustrations, as suggested for your notebook.

3. Note the concepts that seem to be most closely involved in the dominant interests of an individual child. Follow some of these through by questioning to find the way they are organized. Take a sampling of other concepts that do not seem to be involved in the child's interests, and note the differences in what is incorporated in them. Through such a survey, one can roughly place concepts on the scale of an emotional thermometer, indicating the degree to which they are warmed by the active interests and purposes of the youngster.

SUGGESTED READING

1. We sense we are interested in this or that and why we have attitudes of various kinds toward various things. The reader may become more fully aware of the implications of such relational factors in life through reading Chap. 10 on "Insight" of Köhler, W., *Gestalt Psychology*, (Liveright Publishing Corporation, 1930.) Köhler gives many excellent examples which will make one more fully aware of the nature of everyday experience.
2. In Griffith, C. R., *An Introduction to Educational Psychology*, (Farrar & Rinehart, Inc., 1935) Chap. 11 is devoted to "Major Varieties and Theories of Learning." From this chapter, the reader may get much in the way of historical perspective and critical evaluation of theories valuable in gaining an understanding of present-day thought on learning. This reference may be useful as a preparation for Chap. XII which follows, or it may be read to advantage after the completion of that chapter.

Chapter Twelve

Factors that Influence Learning

In the preceding chapter, we have considered how thought and learning take direction; that is, we have considered the essential factors that account for thinking and learning in solving our problems. These essential factors are summed up in the fact that concepts, habits, skills, and interests which enter into thought are organized for the business of making adjustments. They were formed from experience that was adaptive, and so they are organized to enter into more experience to help in making intelligent adaptations to new problems. In these facts, we have the basis for our assurance that learning is purposeful, that it takes direction by setting goals and developing increased insight and understanding in the solution of our problems.

Many Factors Influence Learning.—In addition to these factors which are essential for direction in thought and learning, attention must be given to other factors which condition and limit and facilitate the learning processes. Some of these conditioning factors are so obvious that we may easily underestimate their significance. It is apparent, for example, that human beings learn in a manner typical of human beings rather than of members of some other species such as the apes. Some things we learn easily because we are human beings; others are difficult for the same reason. Another obvious factor in

learning is found in the play activities that we see about us on every hand. Play and the spontaneous activities of children are important to our study because they reach both ways; they are related to the basic patterns that evolve through the growth processes and at the same time are the means through which learned patterns are brought to a well-rounded development. Another influence of basic patterns upon the learning processes is well illustrated by the obvious relation of our emotional behavior to the formation of new patterns; how we learn and what we learn get very much tangled up at times in our emotional dispositions. The maturity of the learner is very obviously a conditioning factor in learning; some learning is appropriate to childhood, some to youth, and some to adult life. Lack of development many times sets the limits to learning and determines success or failure in forming new patterns of behavior. There are great differences in the difficulty of the situations that the learner confronts. At times, for example, we are resourceful in making use of tools that are at hand, thus turning our environment to advantage in making an adaptation to a situation, but at other times we are oblivious to the possibilities because of their difficulty. Then again, a series of situations may be presented in an order that makes it possible to move from the solution of one to that of another; if the more difficult of the series were presented first, without the previous solving of the less difficult, it might be quite beyond our ability to make a successful adjustment.

Because these conditioning factors are so common in the ordinary affairs of life, it is easy for us to underestimate their significance. They will mean more to us if we examine them in experimental situations that reveal their significance. Other factors are not so readily observed, and their significance may be more hidden from the casual observer of human experience. It is not easy, for example, to determine how we solve difficult problems; the experimental study of puzzle solving may reveal significant factors in

learning that we might easily pass by. Emotional factors are notorious in exercising their potency without our being aware of it; in another chapter these will be given special consideration. One may learn much of the nature of learning by a survey of available experimentation in which factors are operative even though we are totally unaware of them; we wake in the morning with a problem solved and have little understanding of how the solution was reached. In the operation of such hidden factors, we have evidence of the universality of insight, which is the name we give to the successive changes that bring new patterns into their completed organization.

Our examination of the operation of these factors, both those that seem quite obvious and those that are not, will result in a clearer understanding of learning. Studying the operation of these in experimental situations we are led to a fuller understanding of the way in which new patterns of behavior form.

Significance of Common Examples.—On every hand, we see learning take place; we take it for granted and pass it by without noting its significance in pointing the way to a fuller understanding. Let us note a simple experiment that might be duplicated in the everyday experience of children of many homes; its equivalent goes unnoticed before our eyes many times. Köhler[1] placed a little girl, one year and three months of age, who was able to walk and run, into a blind alley measuring about 5 feet across the closed end and 7 feet on the two sides. The rear end of the alley was open; at the closed end, the child could see over or through the barrier but could not climb over or through it. An objective, such as a piece of fruit or a desired toy, was placed on the outside of the barrier, and the child was led inside the alley to the closed end where she observed the objective. The child first pushed against the barrier in an unintelligent effort to reach the object, then turned around, looked along the alley, suddenly

[1] Köhler, W., *The Mentality of Apes*, p. 14, Harcourt, Brace & Company, 1927.

began to laugh, and straightway ran to the back of the alley and around the corner to the objective. Here we have an example of a successful intelligent adaptation, with a goal set and insight flowering into a plan of action that met the needs.

Even in the early years of babes such adaptations are common occurrences. They are to be found likewise in the behavior of other species. Köhler[1] gives a report of the successful adaptation of a dog to a similar circumstance. The results closely parallel those obtained with the child. Köhler found on another occasion, however, that the same dog "stood seemingly helpless" when the meat which was used as the objective had been placed close to the barrier where he could smell it easily. The nearness of the meat seemed to result in a blocking of the more intelligent behavior that the dog had previously patterned for the situation. In the successful performance of the dog and of the little girl, the commonly observed characteristics of goal activities are to be found. The objective gets the attention of the learner; the intervening barrier obstructs the simple approach and seizure of the objective; the learner is placed under stress. There is a period of delay for sizing up the situation and evolving a pattern of action, followed by a smoothly executed performance that indicates a definite goal and a definite plan for reaching the goal.

The second occasion on which the dog failed to make a successful adaptation is typical of many observed failures that may be laid at the door of the emotional factors which are deep in the basic behavior patterns of all species. Later in this chapter, an interesting example of the conflict between the emotional and the intelligent aspects of experience will be found in the account of experiments with a young chimpanzee. In a later chapter on "Emotional Control and Social Behavior," special consideration will be given to the interplay of these two factors. For the present, we may say that in this commonly observed

[1] *Ibid.*, p. 13.

experience we find one of the most significant problems of human life.

Köhler's Studies of the Mentality of Apes.—Köhler's studies of apes are replete with most interesting and significant experimental situations. The studies were conducted on the island of Tenerife, off the west coast of Africa, during the World War. The experiments are extensive and give a fairly complete picture of the learning ability of apes. They reveal many characteristic behavior patterns that are common to apes; and at the same time many individual differences among the 8 or 10 apes that participated in the experiments. Most significant for our present purposes is the fact that the experiments cover a wide range of difficulty in the problems involved; some of these could be solved by all the apes and others by only the brighter members of the group, and still other situations were quite beyond the comprehension of all the apes. This variety of experimental situations gives an excellent opportunity to observe the learning process under varied conditions and provides ample ground from which to draw the conclusions that seem to arise naturally out of the studies.

From Spontaneous Play to Learning.—Köhler found that apes developed many activities of the play type. One of these he called stick-jumping, an activity that has a close parallel in the life of small boys who vault themselves about with the aid of a pole. The apes would place a stick or board upright and climb up as far as they could before it fell to the ground. Sometimes they would fall with the stick, and at other times they would jump just as it fell. The apes first did this for fun with no more purpose than children have in walking on stilts. Then one day Sultan,[1] one of the brightest of the apes, used the device to get some fruit that had been hung too high for him to reach. His first attempt was rather desultory, seemingly without any very definitely formed plan. Ten days later, he was more determined in his efforts and had better success. He took

[1] *Ibid.*, p. 69.

a heavy plank, placed it under the fruit, and began to climb the plank and jump off. After three unsuccessful attempts, he succeeded on the fourth trial in jumping from the plank and reaching the fruit. Sultan's achievement capitalized his playful activity of stick-jumping. In the first attempt, the performance pattern does not seem to have been well formed, but in the 10-day period between the first desultory trial and his successful performance it is possible that the pattern gained maturity, much as in the case of Snoddy's mirror-drawing experiments. In his second attempt, Sultan developed a well-formed, purposeful behavior pattern, based on a play pattern that previously had given him satisfaction merely as play.

Ape Performance Is Based on Ape Nature.—As seen in the use of the sticks for jumping, apes capitalize their unusual dexterity and their ability to maintain balance. These abilities show up to advantage in the piling of boxes one on the other to get fruit otherwise out of reach. While engaged in this activity, the apes show a relatively small amount of appreciation for the statics involved, that is, the way in which one box can be placed in relation to the others to make a stable structure. Several of the apes became skillful in piling boxes one on another to reach fruit, but their skill depended more upon their ability to maintain their balance in precarious situations than upon any intelligent placing of the boxes. Grande, a very patient worker, was the best builder of the group; but to the human observers her devices seemed to be perversely designed, for they required the maximum of dexterity and balance and the minimum of what we would call building sense. In the accompanying plate, we have an excellent portrayal of these abilities and limitations in ape nature; the second ape in the picture lends an added interest.

Only three or four of the apes developed any great amount of ability in building; ape nature did not show at its best in this field. The limitations of ape nature in matters having to do with statics is shown in other situa-

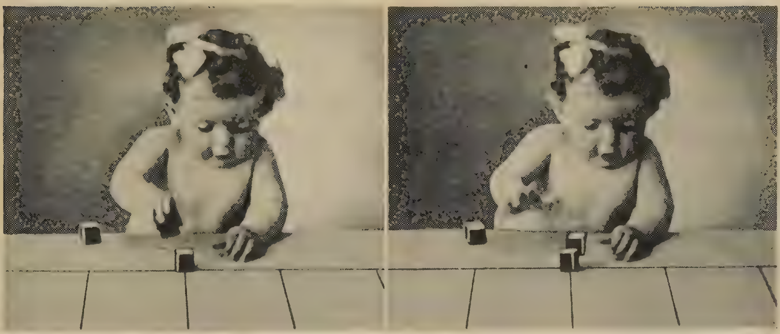
Apes Pile Boxes, Using Great Dexterity but Little Sense of Statics.
(*From W. Köhler, Mentality of Apes, Harcourt, Brace and Company,* 1926.)

tions.[1] The apes were found trying to balance a box on its edges when they could not reach the desired object from the box lying flat on its side. Likewise, in the use of a ladder, Sultan, instead of leaning the two uprights against the wall as human beings commonly do, placed one of the uprights against the wall so that the ladder extended from the wall at right angles. This performance represents something of a carry-over from the stick-jumping. However obtuse it appears in the eyes of human beings, some degree of insight is shown in bringing the ladder and wall together. In contrast to apes with their limited ability in statics, it is interesting to note the ability for building with blocks that develops rather early in the life of children. The play of children seems to follow the lines of their capacities, and much time and enjoyable activity go into this laying of things one upon the other to make something. On the other hand, the apes capitalized another line of development—their agility and remarkable sense of balance. They are equaled in these respects by only the best-trained gymnasts of the human species.

It is possible that the interest in the piling of blocks that we find developing so markedly in the young of human beings is a result of the ability to generalize. As we shall see later the ape has very definite limitations in this line. The examples presented should serve to emphasize the relation between the learning that is done and the basic patterns of the learner, whether the learner is a man or a member of other species. Man cannot learn to fly as do birds, who grow into their flying with the development of basic patterns. But man uses his ability to generalize and to profit by his own experience and that of others and flies mechanically; there is little hope of birds ever making such significant adaptations because of their limited capacity for generalization.

Maturing Opens the Doors to Learning.—Another commonly observed factor that conditions learning is the

[1] *Ibid.*, pp. 158 *ff.*



(*From A. Gesell and H. Thompson, Infant Behavior.*)

(*Courtesy of Los Angeles Public Schools.*)

(*Ewing Galloway.*)

Human Beings Start Building Early and Go Far.

maturity of the learner. To bring this factor more clearly before us, we turn to another of Köhler's experiments. Koko was a young chimpanzee when he was brought to Köhler's colony, and the record of the experiments in which he played a part shows in a vivid way the effect of maturity upon learning.[1] The record of one experiment covers a period of some 20 days, during which time a pattern of behavior was formed, forgotten, and formed again permanently. Very plainly, emotional patterns played a part in what happened. On the third day after Koko's arrival at the colony, he was given a box, about 1 foot in length on each side, as a plaything. He pushed it about and sat on it for a moment; then on being left alone he became very angry and thrust the box aside. An hour later he was moved to another place and chained to the side of a smooth wall; fruit was hung on the wall out of his reach, and the box placed about 10 feet from the fruit. He tried several methods of getting the fruit; then, as he turned away from the fruit, his eyes fell upon the box, which he approached. His eyes turned again to the fruit; he gave the box little, tentative pushes, left it and returned, and again left it and returned, each time giving the box gentle pushes that moved it less than 1 foot. At intervals, during this performance, he looked at the fruit. He turned away from the box for the third time; but presently he returned, seized it, pulled it directly under the fruit, mounted it, and pulled down the prize.

After a few minutes, more fruit was hung on the wall on the side opposite the point at which Koko's chain was fastened, the box being left where he had placed it to get the fruit previously. He first ignored the box. Then, after a time, he suddenly went to it, dragged it most of the way to the spot under the fruit, and stopped and gazed at the fruit; he seemed puzzled and confused and presently went into a rage and knocked the box about, but did not bring it nearer.

[1] *Ibid.*, pp. 43 *ff.*

The next day, even though he seemed more intent on the fruit than before, Koko gave no heed to the box; instead, he tried to reach the fruit with an old shoe, and when he made contacts with the box, he did not seem to be aware of the possibilities of its use. Two days later, the scene of the experiment was changed, the conditions being much the same, with the box about 13 feet from the fruit. He tried several ways of getting the fruit but did not use the box, even though he returned to it as a place on which to sit. Two days later, two boxes were placed about 17 feet from the fruit. Koko eyed them suspiciously from time to time but still tried other methods. Finally, without Koko seeing the change, one of the boxes was placed near the wall and nearly under the fruit so that a short shove would have brought it near enough to reach the fruit. Koko mounted the box, leaned toward the wall, and reached for the fruit, but he did not get down and give the box the necessary push. The next day, the experiment was not repeated, but he was given the box as a plaything. Five days later when the experiment was continued, Koko attempted various ways of getting the fruit but only stared at the box in a peculiar manner and then fell upon it in a rage, threw it about, and kicked it. At times he continued his attempts to reach the fruit but returned in a rage to the box.

Nine days later the experiment was reinstated, Koko not having seen the box in the meantime. The box was placed about 7 feet from the objective. He tried to get the fruit without using the box and then looked at the box for a moment before he went up to it and seized it. It appeared that he might again go into a rage, but instead he dragged the box into position and secured the fruit. When the experiment was repeated, Koko again first stretched for the fruit but presently brought the box into use. At a third trial, he went directly to the box, but at first he did not get it quite near enough and so got down and

pushed it into the right position. On the next and succeeding days, Koko turned to get the box as soon as someone appeared with the fruit.

Anticipations.—In Koko's first successful use of the box, we have an example of what Koffka calls anticipations. The pattern formed, but it seems to have formed prematurely. Koffka cites several such cases of anticipations in young children,[1] that of the niece of Miss Shinn, for example. On the forty-sixth day after birth, this child grasped a pencil and brought it to her mouth; when the pencil was drawn away again, she repeated the performance six times. Not until the eighty-sixth day, however, did the behavior appear again. Another case cited is that of a child of six months who showed a preference for "warm" rather than "cold" colors. The preference disappeared and then reappeared several months later. Another example is that of a child of nine months who at two different sittings employed a string attached to an object to bring the object to him. At a third sitting, the performance had been forgotten, and not until a month later was the situation again comprehended. Koffka interprets such premature performances as arising because of particularly favorable conditions, perhaps both in the stream of experience that preceded the event and in the nature of outer circumstances. The establishment of more permanent learning, it seems, must await the further development of the child. Koko's behavior during the 19-day interval between his first success and the second seems to indicate that the box held for him something that was significant to the business of getting the fruit; the pattern did not form, however, until Koko had had more experience and had matured.

We turn again to the experiment reviewed in Chap. X, involving the pair of identical twins, one of whom was trained over a period of 6 weeks while the development of the other was left to the usual circumstances of life.

[1] Koffka, K., *The Growth of the Mind*, pp. 268, 272 *ff.*, 288, 324, Harcourt, Brace & Company, 1924.

It will be remembered that in stair climbing, 2 weeks of training given the second twin at the end of the 6 weeks placed the two very much on a par. It will likewise be recalled that in cube handling the developmental factor was so dominant that the training resulted in little or no advantage, and in the development of language the efforts to train the one twin produced results that were detrimental.

From these varied experiments and from everyday observations that can readily be made, it should be apparent that nature has her appropriate time for the development of patterns. That this fact is not always respected in the home and school is evidenced by the many cases of precocious children who are pushed into undesirable developments by ambitious parents and teachers. More is to be said concerning this practical problem in later chapters.

Adjustments Made through the Use of Tools.—We make so much use of tools in our lives that we may easily overlook the significance of this method of making adjustments. The learner in using a tool has in a very real sense joined a part of his environment with himself in order to make an adjustment to another part of his environment. The tool is a means to an end. The learner sets his goal—for example, Koko sees the fruit hanging from the wall and is bent on getting it—and, when the goal cannot be attained directly, evolves a means to the desired end through an intermediate adjustment, namely, making use of some part of the environment for a successful adaptation to the situation. The significance of this intermediary adaptation lies in the fact that it points up very significantly the raising of the level of behavior from basic patterns to an intelligent adaptation. The basic patterns provide the means through which Koko might have secured the fruit if it had been within reach or if he had been able to climb the wall. It is interesting to note the emotional factors that are aroused by the frustration of these basic patterns. As we shall see in a later chapter on Emotional

Control, the alliance of the emotional and the intelligent is a critical factor in human development. In the use of tools, we have an opportunity to view experience in which insight raises the pattern of behavior from the immediate supplying of needs to intelligent adaptation.

Let us add to the examples of apes using boxes and jumping sticks, and to the examples that are to be seen on every hand, the record of an achievement by Sultan, one of Köhler's more intelligent apes.[1] Fruit was placed outside Sultan's pen so that he could not reach it directly by extending his arm through the bars. The fruit was also too far removed for him to reach it with the aid of either of two bamboo sticks that were at hand. The experiment hinged upon the possibility of his joining the two sticks together, slipping one of them into the end of the other, so that the fruit might be obtained with the longer tool. Sultan tried first one stick, then the other, and then pulled a box toward the bars but pushed it away again, seemingly deciding that it was not suited to his needs. Then he tried another unsuccessful but interesting procedure of reaching out as far as he could with one of the sticks, then carefully pushing it with the other until he had the satisfaction, evidenced in his animated behavior, of making contact with the fruit through the two pieces of bamboo. Even with the sticks in this position, however, with the end of one placed nicely for joining with the other, the possibility of uniting them went unnoticed. Then a little help was given him; Köhler put a finger into the end of one of the bamboo sticks, did it before Sultan's eyes, but this did not bring results. After an hour, Sultan abandoned his efforts and Köhler left the scene of the experiment. The report of what happened subsequently was given by the keeper who remained. Sultan left the bars, seated himself on a box, and carelessly began to play with the two sticks. Presently, the sticks chanced to be held in his two hands so that the ends were together and the two pieces

[1] Köhler, *op. cit.*, pp. 130 *ff.*

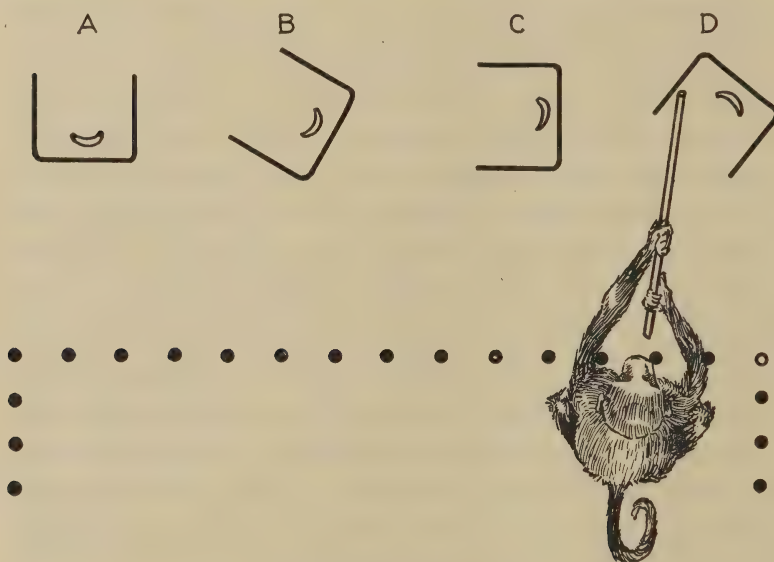
in a straight line. Suddenly, Sultan put the smaller of the two sticks into the open end of the larger, jumped from the box, went to the bars, and started to pull the fruit to him with the joined sticks. The sticks fell apart, but Sultan put them together again and secured the fruit. Next day, Sultan started to fit the sticks together in an ineffective manner but soon changed his plan and fitted them together and secured the fruit. Later, there were interesting developments in the fitting of three sticks together.

In adaptations such as those made by Sultan, we are given an opportunity to observe learning as a highly creative aspect of behavior. Sultan's creative adaptations are suggestive of many that we see in the lives of children. Jimmie might have sat supinely on the floor gazing at the jam in the cupboard; he might have whimpered in discontent without even setting a goal or making a plan of action; he might have cried lustily for someone to give him the jam. His actual performance was a creative effort, rooted in desire to satisfy basic needs, using basic patterns of behavior, but organized into a plan of action in which the chair played a critical role as a means to the attainment of his goal. Such creative evolution of plans and such use of tools as means to ends are most significant, particularly in the life of man in an age in which he has remade his environment through the use of tools.

Learning Depends on Level of Insight and Difficulty of Situation.—Insight depends not only upon the learner but upon the way the problem is presented from without. We do not expect children of four to learn as do those of six; we show our awareness of this difference in the kinds of situations that we present to children. At home and at school, we commonly organize the situations to which we expect children to adjust so that there is a sequence in their experiences, making it possible for the child to meet one level of difficulty with greater ease because of having made an adjustment on a lower level of difficulty. In the experiments that are about to be reviewed, the higher

orders of difficulty were presented first, but they demonstrate nonetheless the relation between the level of insight of the learner and the complexity of the situation presented.

In the experiments selected, the apes were to secure a banana from a drawer open on one side.[1] The drawer was first placed outside the cage with the open side farthest removed from the bars (*A* in accompanying figure). The



Four Degrees of Difficulty.

The four positions of the drawer provide four degrees of difficulty to the apes getting the bananas from the drawers: *A*, the most difficult; *D*, the least difficult.

drawer, and the banana within it, could be reached only with the aid of a stick. One of the apes, Nueva, took the stick and tried to pull the banana toward her but was hindered as the near side of the drawer stopped the banana. She pleaded for help and, when it was not forthcoming, gave up trying. But presently she seized the stick and started pushing the banana away from her toward the open side of the drawer. She edged it along carefully, with but one false move that occurred when the stick slipped to the

[1] *Ibid.*, pp. 225 *ff.*

far side of the banana for an instant, and the banana came toward her again. She corrected this error quickly, however, pushed the banana beyond the sides of the drawer, and then pulled it within her reach. Some of the other apes found this situation too much for them; they solved the problem, however, if the box was turned at an angle of 45 degrees but still faced away from the bars (position *B*). For still others, it was necessary to turn the drawer a full 90 degrees so that the open face of the drawer was at right angles to the bars (position *C*). Again, for others, the face of the drawer had to be turned at an angle of 45 degrees toward the bars (position *D*). These less intelligent apes could see the point in moving the banana if it was not going away from them, but it seemed to be asking too much of ape nature to move it away first before they drew it toward them. The more intelligent apes evolved a pattern in which basic nature was satisfied through an intelligent adaptation that controlled the basic impulse to get immediate possession of food.

The drawer experiment constituted a kind of graded intelligence test, the angles at which the drawer was turned making possible the successive levels of the test. The time taken by the different apes and the unintelligent activity they indulged in were other factors that served to classify one performance as better than another and as a basis for judging the level of intelligence of the various apes. Köhler placed the members of the group in rank order of ability on the drawer experiment, with Nueva and Sultan at the head of the class, followed by Chica, Grande, Tercera, Tschego, and Rana. This order seemed to hold for the evaluation of general ability that Köhler had given them on the basis of their performance in other experiments.

The drawer test shows how the outer situation that presents the problem determines, in part, success or failure in solving the problem. Success may come for the more difficult situations when the problem is approached by easy stages. Once successful at one of the lower levels

of performance, some of the apes were later able to advance to the next higher level. Köhler found that Koko's arms were too weak to manipulate the stick effectively, and it was therefore not possible to determine the level of insight to which he might have attained if he had not been thus handicapped. A little boy of two years and one month was found to be less skillful than Sultan in manipulating the stick and more skillful than Rana and Tercera. The child could bring the banana to him when not hindered by the drawer, but, like Koko, he was unable to manipulate the stick when the fruit was placed in the drawer. Thus, we observe the variety of limiting factors that enter into learning.

Limits of Learning Set by Ability to Generalize.—It has been repeatedly pointed out, not only that human learning involves the ability to adjust to the situation before the learner, but that in the long run the life of the learner depends upon his ability to profit by his experience, upon his ability to generalize. Let us turn again to Köhler's apes to note the limitations in their ability to generalize, and then let us examine some experimental evidence with human beings as the subjects, having for our purpose a clearer understanding of man's ability to profit by his learning. In so studying the processes of generalization, we are in a sense reviewing the materials of previous chapters by approaching the study of organization of experience as it operates in the solving of problems.

Köhler gives many examples[1] that show the limitations of the ability of apes to generalize. One example is found in Sultan's attempt to place a box on cans which rolled under it. Not only did he not attempt to remove the cans and provide a firm place on which to put the box, but when by accident some of the cans rolled away and left a clear place, he persisted in trying to balance the box on the cans. Another example occurred when Sultan wanted to move a box in which three heavy stones had been placed. Finding

[1] *Ibid.*, pp. 154 *ff.*, 119, 124 *ff.*, 171.

the box too heavy, he removed one stone, found the box still too heavy, removed another stone, and then moved the box with great effort, without removing the third stone. Another field of activity in which some degree of insight is manifest, but in which the limitations seem to be in contrast with human abilities, is found in the cooperative efforts of the apes. They do cooperate at times, but more often their behavior reveals a decided inability to evolve patterns in the nature of social planning. For the most part, their successful learning took place in situations that were before their eyes. In some few instances, the brighter apes secured tools that were out of sight, but any behavior that indicated thinking which included objects not immediately present was unusual. Since the mental process thus held quite strictly to experience that involved sensory presentation, we may infer that little in the nature of concept formation took place.

The apes usually profited by their experience if it was a matter of increasing their physical dexterity, but these habits did not go far in the way of the generalization needed to improve future performance. Köhler observed that, except for the physical skill involved, the repetitions of an experiment commonly resulted in lower levels of performance rather than in better comprehension of the situation. He states, "I must say that I like the behavior of the chimpanzees during their tenth or eleventh repetition of a solution less than in the first or second—the chimpanzee's genuine solutions, at any rate, do not become more valuable in themselves through repetition, even if they appear more quickly."[1] This limitation may be interpreted as one of lack of generalization or perhaps of inability to organize the generalization on progressively higher levels. It might be expected that skills which involve physical dexterity would be conserved, since there is a sound base of native patterns to which these new patterns may be related. In the field of generalization, however, it appears

[1] *Ibid.*, p. 98.

that apes are short on the formation of concepts on which man relies for the organization of his behavior. In contrast to apes, we commonly observe a child learning that one block must be placed upon another if it is to remain secure and provide a base on which to pile other blocks. He learns for the particular situation and then goes on to more difficult problems, carrying with him ways of going about his work and other generalizations that make his new learning more successful. We find children giving evidence of these generalizations in speech, for they are continuously asking how to do things better, and then making plans for improvement. Undoubtedly, man's ability to think problems through is facilitated by his use of language symbols.

Generalization in Puzzle Solving by Human Beings.—Ruger made a careful study of learning on the higher levels by asking adults to solve various puzzles made of wire looped together.[1] The time was kept for each successive solving of a puzzle, notes were taken by an observer of the way the subjects went about their problems, and the subjects were asked to relate their experience as they interpreted it. A gradual decrease in the time taken to solve the puzzles was a characteristic that appeared in the records of most of the subjects. At times, however, a subject would stop to look for a clew and might thus increase the time for one solution as compared with the last. The oral reports of the subjects indicated that this search for clews to the solution was common to all their experience. The finding of a clew resulted in a sharp drop in the time taken to solve the puzzle, and once it was found the longer time was generally not required thereafter. It was a common experience for the subjects to sense that they were "getting warm" before they were definitely aware of the nature of the clew.

What appeared to the observer of the Ruger experiments to be the discovery of the same clew proved many times

[1] Ruger, H. A., *The Psychology of Efficiency*, Bureau of Publications, Teachers College, Columbia University, 1910.

to be of decidedly different significance in the learning of one subject as compared with another. Some subjects took their clews for what they were worth in the immediate present and for the situation at hand and let it go at that. Others were inclined to run down a clew to find out why a certain move released certain parts of the puzzle. We recognize in such a search for essentials a characteristic of the process of generalization. The learners who searched out the why of the clew had a decided advantage when another puzzle of similar nature was attacked. The subjects who took things for what they were worth and let it go at that came to similar puzzles and repeated the same long routine of working out solutions on the firsthand basis that they had employed in their previous experience. If the reader has an opportunity to try a few such puzzles, he will observe in his own experience, as did Ruger's subjects, that he will sense he is about to find a clew before it appears definitely in consciousness, and he will perhaps be able to observe many levels of insight that accompany different stages of generalization.

Interpretation of "Trial-and-error" Learning.—It is interesting to conjecture as to what is happening to the learner in the various phases of puzzle solving such as we find in the Ruger experiments. Particularly interesting is that phase in which repeated trials are made with only a very gradual decrease in the time curve. Learning of this slow type with its many repetitions is called *trial-and-error* learning. Out of experimentation with this type of learning, Thorndike[1] formulated the law of exercise. This law has been discussed in Chap. VIII in connection with more recent experimentation by Thorndike which indicates that repetition in and of itself does not account for learning. Among Thorndike's experiments of many years ago were those with cats which were placed in cages with food outside. The cats learned to get out of the cages by dis-

[1] Thorndike, E. L., "Animal Intelligence," *Psychological Review*, Supplement 8, 1898.

covering the way to unlatch the door by means of a device that they could manipulate. The time curves for the learning of the cats in Thorndike's experiments are much like those for Ruger's human subjects; there is a slow drop in the time taken for successive trials, followed by a sudden fall[1] in the curve which suggests that out of the slow development there suddenly flowered a pattern of behavior which led to the easy solution of the problem in subsequent trials. In Thorndike's experiments as in those of Ruger, the sudden drop in the time curve came in some cases after a few trials, but in most cases it came after repeated trials which gradually grew shorter in the time required for each.

More recent experiments of Thorndike[2] throw new light on what takes place in the trial-and-error phase of learning in which the subject is not conscious of what is happening. These interesting experiments definitely relate this phase of learning to the flowering of insight when the time curve suddenly drops and the learner comprehends the situation and proceeds readily to the solution of the problem. One of the experimental situations may be taken as an example of many that were devised and carried out. It appeared to the subjects to be a test of foreign-language vocabulary. Down the left margin of the page was a list of foreign words, each followed in the same line by five English words. One of these was to be underlined by the subject to indicate that he chose it as the correct English equivalent of the foreign word. When the subject underscored the right word, he was told that it was "right"; if he chose the wrong word he was told that it was "wrong." Telling him whether he was right or wrong provided an effect or a consequence that gave the subject a sense of

[1] Recent experiments under varied conditions show this more pointedly; see Adams, D. K., "Experimental Studies of Adaptive Behavior of Cats," *Comparative Psychology Monograph*, Vol. 6, pp. 1–162, 1929.

[2] Thorndike, E. L., *Human Learning*, pp. 30–81, D. Appleton-Century Company, Inc., 1931.

direction. The experiment, however, centered in a factor that was introduced without the knowledge of the subject, a hidden factor of such a nature that it might possibly operate as an effect or consequence even though the subject were unaware of it. This hidden factor was introduced into the experiment by varying the frequency with which the right answers appeared in the five positions in the line of alternative answers. For each 100 items of the test the right answer appeared ten times in the first position, fifteen times in the second position, twenty times in the third position, twenty-five times in the fourth position, and thirty times in the fifth position. The subject did not know that the frequency of right answers was distributed in this way. The point in the experiment was to see what influence this hidden factor would ultimately have on the choice of answers.

It was found that the hidden factor in this experiment, and in other experiments designed for the same purpose, did influence the responses. Gradually, the choices of the subjects became more accurate, even though they were not aware of the arrangement of the alternatives in the answers; the occurrence of more right answers at the end of the line influenced the learning. This was made apparent by statistical analysis of the data, but perhaps the most convincing proof was the fact that some of the subjects became conscious of the presence of the hidden factor. As in Ruger's puzzle-solving experiments, the clews gradually emerged into a conscious pattern for some of the subjects.

These experiments seem to the author to be a convincing demonstration of the fact that *insight* is a subtle process in learning, operating in ways of which we are little aware. To state this in another way, changes in the pattern of learning take direction without the operation of insight on a conscious level; insight operates, not only in those parts of the learning experience which rise to dominance in consciousness, but in those parts which are in the background as well. The operation of unconscious insight is

first revealed to a few subjects when they begin to sense dimly the presence of the hidden factor; this sensing is followed by a definite awareness of it, when, as Thorndike says, it "blossoms into a rule of action supported by judgment."[1] The experience of these subjects of Thorndike's parallels that of Ruger's subjects in puzzle solving, who sensed the operation of clews, before they were fully aware of them, and then became definitely conscious of them.

From the point of view taken in this book, insight is the name that is rightly given to the progressive changes that lead to the formation of an adaptive pattern. It is just such changes that operate in much of our behavior, tending to make it more intelligent, tending to bring us into better adjustment to our environment. Sometimes we sense the operation of these changes; sometimes we do not. Sometimes when we have been oblivious of them we suddenly become aware of them and discover the potency with which they have been operating. Suffice it to say that our everyday experience is thoroughly in agreement with the facts as revealed by Thorndike's experiments. The learning process goes on whether we are aware of it or not.

Summary: Perspective Needed for Interpreting Learning.—From the point of view that has been dominant throughout our study of human nature, it appears that a basis for interpretation of learning depends upon several issues, one of which is our conception of insight and the way in which it operates in problem solving. That there are several phases of problem solving seems obvious from our common experience. Faced with a new situation, we all halt and size it up. This is a period of orientation, evidenced sometimes by considerable fumbling, fumbling with a puzzle actually in our hands or fumbling mentally as we try to make head or tail of the problem before us. We may think of the second phase of such learning as that of getting a sense of direction, a phase that is closely connected with the first but that results in gaining a sense of

[1] *Ibid.*, p. 77.

direction and perhaps in setting up a goal. These phases give little to the experimenter to record in time curves, and the record when taken shows little progress in the relative time of successive trials. The casual observer may see evidence of much more significance than that of the time curve in the learner's change of facial expression, showing emergence from the fumbling. Such an observer will also interpret rightly the significant pause that follows and marks the selection of ways and means for proceeding effectively. Even more significant than the interpretation of an observer is the experience of the learner himself, who cannot mistake the importance of these preliminary changes in the developing pattern out of which will come ultimately an intelligent solution. The learner knows that this orientation is significant to what follows, and since we are all learners we are one in this matter, though time curves may hide the real significance that common sense reveals so truly. There is no doubt in the mind of the learner that the subsequent steps in the learning are dependent upon these halting first steps in getting oriented, in sensing direction, and in setting goals, however tentative they may be.

We as human beings find our attention and interest naturally captivated by the subsequent phase of problem solving, in which there is a sudden flowering of insight as the pattern forms. This is most flattering to an intelligent being. To many, it may be disconcerting to find that goldfish, cats, and apes possess this capacity for sudden insight, even though it be on a lower level; we would like to reserve for human beings this more dramatic evidence of intelligence, leaving the so-called trial-and-error learning to the lower animals. The facts, however, dictate a concept of insight that operates throughout all levels of learning. Wherever there is evidence of progressive changes in the learning process, there we have insight. Our common experience gives ample evidence of the slow orientation period and of the slow development of understanding, just as it gives evidence of the sudden making of the well-

formed pattern. The cat and the ape cannot exclaim, "I have it," as does the human being; but the time curves tell the same story when the learner is faced with a difficult situation. First, there is slowly developing insight that is natural to the period of orientation; then there comes the flowering of insight as the pattern forms. The evidence of this latter phase is not hidden in either animal or human learning. The cat gets out of the box; Sultan is away on the run as he fits the two pieces of bamboo together; and man, perhaps with a restraint becoming his higher level of emotional control, says, "I think I have a clew to the solution of this exasperating puzzle; let us see what I can make of it."

The processes of maturation are essential to good learning. Through them we make the most of the insight which has come with the formation of the pattern and has ended the slow gaining of direction. The development that follows insight may be slow, also. Newly formed patterns do not always work to best advantage; the adaptation may not meet the situation fully or the next occurrence in the situation as it is presented. The new learning may therefore be tried in varied situations, an experimental type of procedure which will reveal the essentials that may be useful in varied experience of the future. The goal set at the beginning of the learning was a working goal only to give direction to the initial developments; it may be succeeded by a series of changing objectives which broaden the scope of the problem and give it more significance in the life of the learner. The new learning is, in a very real sense, a reorientation of the life of the learner; it is good learning if it expands the life of the learner through greater ability to learn in the future.

The maturation of new patterns of behavior is essentially generalization, an organization of the experience upon higher levels of insight. Ruger's more intelligent subjects did not stop with the firsthand application of their clews; they looked for the underlying relations that they knew

could be found behind the more obvious clews. They looked for more than what a clew could do immediately; they looked for the how and the why of its operation and thus consciously prepared for the solution of other puzzles. This was true also of the subjects of the Bryan and Harter[1] experiments in telegraphy and of Book's experiments in typing, who found their steady progress leveling off into plateaus from which progress could again be made only through the organization of higher orders of behavior. These higher organizations ultimately involved the life pattern of the learners. Through this alliance, a framework was given in which the increasing mass of details could be brought to more advanced levels of performance. The learner, in turn, became a new being, with new purposes and new insight into the significance of his work.

An adequate understanding of learning depends upon this larger view of the whole process. Each phase of the total experience can best be understood when seen in relation to other phases. When attention is centered in one phase of the learning experience to the exclusion of other phases, the learning appears different, and we are therefore led to speak of different kinds of learning. The crux of the matter lies in the fact that in all phases of learning the adaptive capacities of the learner are in operation, resulting in progressive changes that lead to adjustment to the situation. Insight is the name we give to these progressive changes, and these changes are present in all phases of the process. In the period of initial delay and orientation to the new situation, the changes may show to poor advantage in a time curve. This points to the need of perspective, the need of applying common-sense values that will give due regard to the evidence of everyday experience in which we see the worth of getting direction and setting goals before making a more direct attack upon a problem. Seen in this way, it is a fitting part of the larger scheme of things. Getting oriented is a natural phase of

[1] See Chap. X.

learning; slow progress is to be expected until goals are more clearly formed and direction of the experience is determined. More rapid progress is to be expected once direction is sensed and goals set up. Insight flowers naturally. But the pattern cannot form out of thin air, it forms as a natural sequence to what has gone before. This dramatic phase of learning should not blind us to the maturation of the pattern; it is significant that nature prizes this fulfillment.

We get the fuller view of the total process if we see the particular learning as an incident in the developing stream of life of the individual. The particular new learning gets its due significance in relation to the higher purposes to which it leads; it becomes of most value as an integral part in a hierarchy of behaviors that lifts life to a higher plane. From the perspective of this larger view, our concern with learning centers in the development of the personality of individuals. No two learners are alike; no two learners will live the same lives or meet the same problems. Learning in the lives of these individuals takes its own pace, dependent upon inherited factors, which determine in part the rate of development, and upon the circumstances of life, which give opportunity for natural capacities to develop through significant experience. Native patterns form the basis of existence, and out of the individual's experiences in making the most of life there emerges a distinctive personality. In the chapters that follow, the problems of human development and intelligent adaptation are considered as they relate to the lives of individuals.

SUGGESTIONS FOR NOTEBOOK AND BULLETIN BOARD

1. Organize illustrations that represent the various phases of problem solving, such as,
   a. The period of initial delay.
   b. The period of orientation in which initial goals are set up.
   c. The flowering of insight when the pattern forms.

   d. The maturation of the new pattern, through: (1) use in varied situations; (2) incorporation into higher orders of behavior such as interests and life purposes.

2. Develop a graphical illustration to show the process of learning as a progressive series of changes. In such an illustration, the following factors might be shown in relation to one another:
   a. The changes in the learner as he develops new understanding; this factor might be represented by a series of capital *L*'s with subscripts 1, 2, 3, 4, 5, . . . to indicate the changes.
   b. The changes in the situation as it is interpreted by the learner; this factor might be represented by a series of capital *S*'s with subscripts 1, 2, 3, 4, 5, . . . to correspond to the changes in the learner.
   c. The goal, as it is originally set up, and the subsequent changes in it as the learning progresses. The projected goal might well be placed at a distance, giving direction to the changes in the learner and the situation as he interprets it; possibly the three factors might be represented as drawing together as the problem approaches solution.

Such a graphical illustration is of most worth to the one who makes it. The suggestions made above should open the way for ingenious arrangements and designation of factors in relation (possibly shown by arrows) so that the total process may be illustrated. It is interesting to ponder on how the developing insight might be illustrated; it should, of course, represent the trend and direction of the changes in all the other factors.

DIARY OF YOUR OBSERVATIONS

The everyday life of children and adults is a continuous series of problem solvings, offering to the observant student a wealth of firsthand material for his study and interpretation. No two of these situations are alike, and the particulars vary greatly.

1. Spend an hour or two observing children of various ages, make brief note of one learning situation after another, and interpret as best you can the phase of the learning process in which the learner seems to be at the time of your observation. Thus, you

might find a six-year-old child quite confused at the beginning of his first day in school. Another one has "broken the ice," but is obviously still getting oriented. Another who has been in kindergarten is busy with a small group of other children working away on the building of a train; if one listens to the conversation, it will be apparent that the project was not clearly conceived at the beginning and that the goal is changing with the development of the project. Other phases may be seen, perhaps at other age levels and in quite different situations. Here is a group of eleven-year-olds getting in their daily practice for a ball game that is ahead. Perhaps this same group may be found in serious and heated argument over some rule violated, and one is sure to find appeal made to ideals and higher orders of habits to determine the justice and the worth of one decision as compared with another.

2. Many interesting experiences may be recorded from the life of the student himself which will give point to the purposes of this chapter. A few of the many possibilities are here suggested:
   a. Let the members of a study group make a collection of simple puzzles and try their hand at the kind of experience in which Ruger's subjects engaged. A puzzle book from the children's shelves of the library will offer many suggestions. Make a record of your experiences.
   b. The mirror-drawing experiment suggested in Chap. VIII is a problem-solving experience that will reveal the essential phases of learning very well indeed.
   c. Record personal experiences in which insight has developed without your being conscious of it, problems that were solved while you slept, bursts of understanding that came when you were occupied with matters quite unrelated.
   d. Perhaps you recall experiences that have been of the nature of anticipations, new patterns that formed and slipped away from you, to be learned better and more permanently at a later time.

SUGGESTED READING

1. The reference to Griffith, C. R., *An Introduction to Educational Psychology*, suggested at the close of the preceding chapter, should be noted again. Chapter 11, "Major Varieties and

Theories of Learning," will give a broad basis for the interpretation of the problem of learning. Chapter 12, "Engineering the Learning Process," gives summaries of many studies on various special problems in learning. In reading these chapters, the student will find occasion for comparing the point of view and the developed scheme of thought of the present book with the same problems as interpreted by others. Many points of agreement will be found, at times hidden by differences in phraseology. In general, the differences are differences in emphasis placed upon various factors influencing learning.

2. Attention is called again to a reference given at the end of Chap. IX: *Educational Diagnosis*, Chap. 10, "Maturation as a Factor in Diagnosis," Thirty-fourth Yearbook of the National Society for the Study of Education, 1935. This reference lends weight to the summary of the present chapter in its appeal to a common-sense basis for interpretation of learning.
3. Dewey, John, *How We Think* (D. C. Heath & Company, 1910) gives an interpretation of thinking in problem solving by which the learning process is divided into five phases. The reader will be interested in noting the similarity of this analysis and the reader's own interpretations of everyday experience.
4. The critical student will find Bode, B. H., *Conflicting Psychologies of Learning* (D. C. Heath & Company, 1929) a good example of the reexamination that our educational psychology is undergoing. Chapter 13, "Another View of Purposive Behavior," is particularly applicable to the present study.

Chapter Thirteen

The Inheritance of Individuality

In the preceding chapters, we have had occasion to speak of individuals, of Jimmie, Jane, and their baby brother, of the French mathematician, the sales manager, and others. The reader has at times been asked to examine his own experiences and to observe different children of different ages. Although these individuals may have been interesting in themselves, yet the main purpose in considering them has been to learn of human behavior that is common to all human beings. The plan has been to learn how human beings are alike, in order that we may better understand their differences. In this chapter and in those following, we shall be concerned with these differences, having for our purpose the development of an understanding of how people come to be born different and how they develop the personalities that make them even more different.

Differences Are the Rule in Human Nature.—We have found human beings sufficiently alike to enable us to get a general understanding of them, and yet they are universally different one from another. Identical twins are the exception to this general rule, and they seem strange to us because they are much alike. Children of the same family reveal differences that are sometimes most astonishing and disconcerting. Brothers and sisters are born of the same parents, they spring from the same family lines of grandparents and great-grandparents, they belong

to the same race that has its characteristic similarities, they are human beings with the likenesses of the same species; but with all these converging forces tending to make them alike, brothers and sisters come into the world with inherited differences. In addition to these initial differences, their potentialities develop in relation to environment in ways to make them still more different.

In order to get along with our fellow human beings, we continually search for the likenesses and the consistencies in human nature to find a stable basis for directing and controlling our relations. Through such general understanding we gain confidence in our ability to live with our fellow beings, but we still find life most surprising at times because of the differences that lead to unexpected behavior. It is very apparent that our generalizations are useful, but it is also apparent that they are useful because they give us a basis for understanding the unusual as well as the usual in fellow human beings. We live with individuals and not with averages; yet knowing the average we can better understand the individual.

Problems of Individuality.—The idea of organizing thinking about differences seems at first to be in itself a contradiction, since we look for likenesses rather than differences as the basis for our generalizations. Nevertheless, there is much in studying the differences in human nature that will give us insight and understanding. To begin with, we are born different because of the consistent interaction of definite factors of genetics and of development. It will be recalled that in Chap. III the significance of growth potentials was discussed. The carriers of these growth potentials, known as *genes*, are grouped in larger units called *chromosomes*. It is helpful to have some basic understanding of the dramatic sorting and combining of genes and chromosomes that are responsible for inherited differences. It is the main purpose of this chapter to gain this understanding. Naturally, consideration will be given to the way these original differences develop in relation to the environ-

ment of the individual. Environment varying, the differences become even more diverse.

Why Children Are Not Exactly Like Either Parent.—Children may resemble one parent more closely than another; they may resemble one grandparent more than another grandparent; but they are wholly like no one of them, parent or grandparent. The nose that is like the mother's, the eyes that are like the father's, and the general resemblance to a grandparent rest on the similarities in cell structure and cell organization that make up these parts of the body. These similarities between child and parent arise for the most part from the original growth potentials found in the genes of the single cell from which the complex organism developed. All the different cells that make up the particular features come from the same origin, the single cell that is the result of the union of the male and female germ cells. Coming from the same origin, all the cells of the body may be said to have originally possessed the same potentials for development. In the process of growth, they become varied, they develop in relation to other cells and in relation to the environment, they differentiate and specialize and become particular but coordinated parts in the behavior of the complex organism.

It is only through the influence of the growth potentials of genes that are handed down from grandparents through parents that we can account for the fact that children can be like a parent in some respects and not in others. The germ cells of the parents are like the other cells of the body in the growth potentials they carry; they carry two sets of chromosomes, one set of which comes from the mother and the other from the father. Since each set comes from parents that are different, they too are different. Unlike the other cells in the body, the development of the germ cells has been held in abeyance until they are matured for union with the germ cell of the opposite sex. In the short period of maturation, the germ cells undergo great changes, in the course of which the two sets of chromosomes are put

in a state of flux and those of one set become interchanged with those of the other. The result is two new sets of chromosomes, one set of which becomes isolated, leaving but a single set of chromosomes in each germ cell at the time of their union.

Thus, a germ cell that has been like other cells of the body until the time of its maturation, is quite unlike them when it unites with the germ cell of the opposite sex to create a new individual. Some of the chromosomes of each of the two sets that have been responsible for the characteristics of each parent are, to be sure, passed on; but since only half of the total are retained, it is apparent that the new individual cannot be wholly like either parent. It is likewise apparent that in some respect or another he is apt to be like each parent and like grandparents from whom various chromosomes of the two sets have been inherited.

Thus, we find that there are definite causes that lead to inherited differences. To get a general view of the causes of children being like parents and grandparents in some respects but like no one of them in all respects, it is well to summarize in its main outline this scheme of inheritance. Here are the essential factors that determine the inherited nature of a new individual:

1. The parents of the new individual are different in their inherited natures. They look different, and they act differently.

2. The growth potentials in chromosomes and genes in the germ cells of the parents are as different as the original potentials of the other cells of the parents.

3. The germ cells, male and female, in their dormant state contain each two sets of chromosomes, of which one set came from the grandmother, the other from the grandfather, of the respective parents.

4. Male and female germ cells undergo a process of maturation just previous to their union; during this period, the two sets of chromosomes are put in a state of flux, and

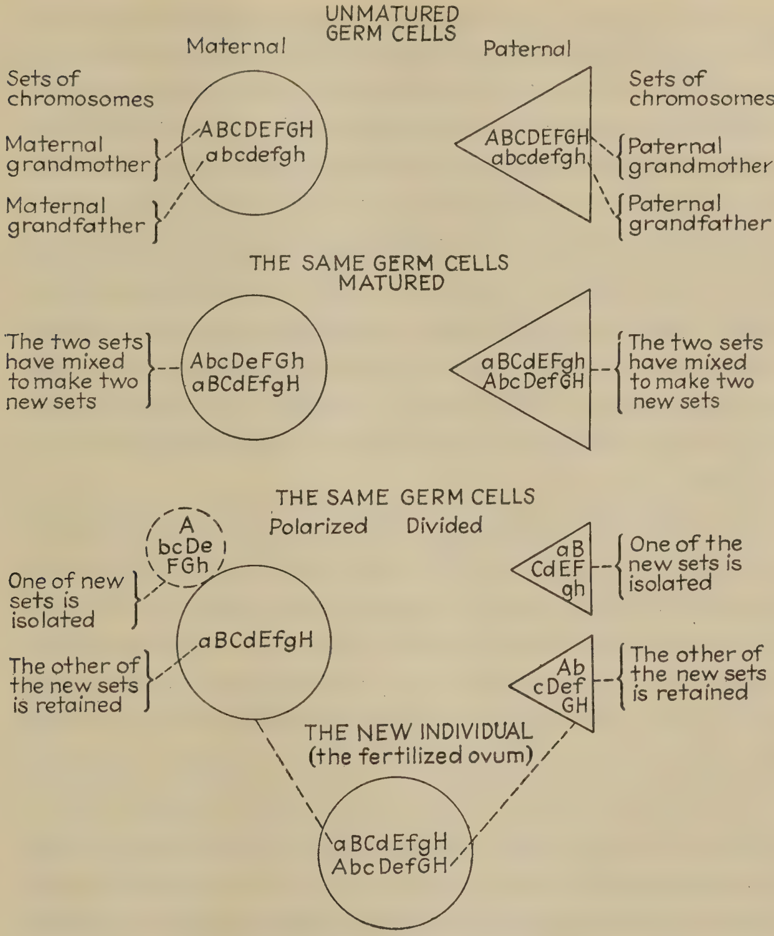
when they reorganize from this state they become rearranged into two new sets through the interchange of chromosomes.

5. Of the two new sets in each germ cell, only one is retained for the union of the two cells.

6. The new individual develops, as far as growth potentials are concerned, in line with the combined influence of the genes of the two sets of chromosomes that entered into the union of germ cells.

In the accompanying figure will be found a diagram of the changes that take place in the sets of chromosomes as the germ cells mature and unite to create the new individual. This illustration follows the outline given above in all essential respects. In brief, we find sets of chromosomes that represent respective grandparents of the maternal and the paternal lines of ancestry. In the maturation of the germ cells, the two sets of the respective germ cells interchange chromosomes. One of the resulting sets is eliminated through the polarization of the cells, and the other carries to the new individual but one-half the total of chromosomes of the original unmatured germ cells. Thus, the genes of the germ cells that are carried to the union represent parents only in part, grandparents only in part, and great-grandparents only in part. In general, the more remote the generation of ancestors, the less the influence. In his studies of heredity, Sir Francis Galton, eminent English scientist of the last century, formulated his law of inheritance which generalizes this progressive regression of the influence of successive generations. The law applies only in a very general way, but it serves to give the picture of inheritance. It states that, on the average, in the hereditary influence upon children, one-half may be assigned to the parents, one-fourth to the grandparents, one-eighth to the great-grandparents, and so in decreasing amounts to more remote ancestors.

Details of Maturation and Polarization.—In reviewing the six essential factors that determine the inheritance of



Maturation and Union of Germ Cells.

Changes in the sets of chromosomes are shown in the four stages: (1) the unmatured germ cells, each with two sets of chromosomes; (2) the matured germ cells with interchange of chromosomes between sets; (3) the isolation of one set in a polarized egg cell and a divided sperm cell; (4) the new individual with one set of chromosomes from the maternal line and one from the paternal line.

an individual, it is apparent that the process of maturation of the germ cells and the polarization and elimination of one of the two sets of chromosomes are of great importance. It is through these developments that the chromosomes which enter into the union of the germ cells are determined upon. Let us turn to a more detailed description of these phases of inheritance, first considering the maturation of the egg, or female germ cell, and then later that of the sperm, or male germ cell. As we proceed with further details, the reader should be reminded of the fact that there is much that is still unknown about inheritance. The main outline is fairly certain, but the complexity of factors calls for caution in interpreting the facts that seem to be fairly well settled.

The egg cell originates through the division of another cell of the body. In its dormant state, its genes are gathered into minute chromosomes embedded in a small mass of cytoplasm which makes up the main body of the cell. The genes at this time cannot be observed under the microscope; but as the egg begins to mature, the chromosomes can be observed as they become enlarged and soon touch and fuse to form the nucleus. This increase in size of chromosomes and nucleus is accomplished by the absorption of materials from the cytoplasm that surrounds it, and in turn the chromosomes return materials to the cytoplasm. The growth of the cell in this stage is very active; it takes food materials supplied by the blood stream, and it increases in size. The nucleus in the meantime has developed into a very large sac called the *germinal vesicle*. Finally, the membrane that encloses the nucleus dissolves, and the fluid that it contains flows out and mingles with the cytoplasm. There have been reserved in the nucleus minute portions of each chromosome and therefore of each gene, and presently the nucleus divides twice in such a way as to eliminate from it one of the sets of chromosomes. The eliminated portions appear first on the surface of the egg cell in one or two small polar cells which soon become

separated from the germ cell and have no further bearing upon reproduction. One set of chromosomes having been eliminated, the egg cell is now prepared for the reception of the sperm cell. The cytoplasm is already organized for the first steps of cell division that follow fertilization; even at this early stage, the egg cell begins to organize the materials of the cytoplasm into three zones which, after the fertilization by the male cell, will develop into the three basic tissues which we have described in Chap. III.

How Sex Is Determined: The X Chromosome.—The development of the sperm, or male germ cell, follows much the same course as that of the egg cell, except that there is only a small amount of material in the cytoplasm of this highly motile cell. The changes that take place are in general much the same as in the maturation of the egg. As the sperm matures, there is the same flux of chromosomes and recombination into two reorganized sets, followed by a division of the cell which results in sperm cells with but one set of chromosomes to each cell. Both of the original sets carry the quota of 24 chromosomes, which number is characteristic of human beings, but it is important to note that one of these sets contains but 23 chromosomes which are functional; in this set one of the chromosomes, called the *Y chromosome*, plays no significant part in inheritance. The corresponding chromosome of the other set is called the *X chromosome*. In the egg cells, the X chromosome is found in both sets of chromosomes; therefore, in the union of the male and female cells, the egg will always contribute an X chromosome, whereas the particular sperm cell that enters into the union may carry an X chromosome or a Y chromosome. The sex of the new organism is therefore determined by the set of chromosomes carried to the union by the sperm. If the sperm is one carrying a set with a Y chromosome, it unites with the set in the egg that always carries an X chromosome to create a male individual. If the sperm carries a set with an X chromosome, it unites with a set with an X chromosome in the egg to create a

female individual. In other words, males develop when an X and a Y chromosome are paired in the fertilized egg, and females develop when two X chromosomes are paired in the fertilized egg. We shall presently return to this interesting determination of sex, but in the meantime let us complete our narrative by seeing how the newly paired sets of chromosomes and genes of the new individual interact upon each other to determine, in part at least, the character of the new individual.

Characteristics Are Determined by Interaction of Paired Genes.—It is the combination of two X chromosomes that leads to the development of the female characters, and it is the dominance of the X chromosome over the impotent Y chromosome that determines the male characters in an individual. In a similar manner, other characteristics are due to development that is influenced by the combined action of pairs of chromosomes and genes. We note again that the male cell brings to the union but one of two sets of chromosomes of the new individual. This set may have more of the genes of the paternal grandfather than of the paternal grandmother, or the reverse may be true. The female cell also brings to the union but one of two sets; this set may be composed of genes predominantly from the maternal grandfather, or it may carry genes that represent to a greater extent the maternal grandmother. Four general combinations may therefore enter into a given union, depending upon the fertilizing sperm and upon which set of reorganized chromosomes has been retained in the egg:

Either

1. A sperm carrying a predominance of genes from the paternal grandfather.

   or

2. A sperm carrying a predominance of genes from the paternal grandmother.

may unite with either

3. An egg carrying a predominance of genes from the maternal grandmother.

   or

4. An egg carrying a predominance of genes from the maternal grandfather.

Thus it is possible that the newly created individual may arise from the union of 1 and 3, 1 and 4, 2 and 3, or 2 and 4.

With the union of the two germ cells, the respective chromosomes of the two sets become paired; the X chromosome of the female cell is paired with the X chromosome of the male cell if there be one in the set in the male cell, and each of the other 23 chromosomes is likewise paired with its corresponding member in the other set. Thousands of pairs of genes, organized into hundreds of groups, are thus brought into relation, and out of the interaction of these genes one with another, and out of their interaction with the cytoplasm and the inner environment of the organism, arise the factors that control the development of the basic pattern of the new individual.

Characteristics of the New Individual.—Will the new individual be like his father? Like his mother? Like a grandparent? If so, in what respects? What interaction of genes will be responsible for producing groups of cells that will become formed into a long, aquiline nose, or into a short, retroussé nose? Will the child be stubborn or amiable? Musical or tone-deaf? Highly intelligent, mediocre, or feeble-minded? Will he have the normal character of blood clotting or be afflicted with hemophilia like the sons of some of the world's deposed royalty? Why do some of these characters persist generation after generation in spite of crossbreeding, like the persistence of the white faces of Hereford cattle?

When we seek answers to these questions we are concerned in general with three factors: (1) with the flux and

re-sorting of chromosomes previous to the union of the germ cells, (2) with which sets of chromosomes in egg and sperm unite to create the new individual, and (3) with the relative potency of the genes that become paired in this union. With the two paired groups brought together, the issue then rests with the relative potency or dominance of certain genes of one set over the paired genes of the other set. Let us study the operations of these three determining factors with the use of an example.

Dominant and Recessive Genes.—Under what conditions can one predict that a baby will have blue eyes? Only if both parents are blue-eyed. If they are, this fact means that each parent carried in both sets of chromosomes blue-eye groups of genes. We know this because blue-eye genes are recessive when paired with other eye-color genes. The term *recessive* always has this relative meaning; it indicates those of the paired genes which do not show as characteristics of the individual because their influence is overshadowed by that of dominant genes. The *dominant* genes have their way in the actual development of the individual; the recessive genes give way to the influence of the dominant genes. They in a sense recede into the background. For example, blue-eye genes are recessive to brown-eye genes; and if the latter appear in either of the sets in the new individual, they cause the eyes to be brown. Brown-eye genes have their way when paired with blue-eye genes, and the individual is brown-eyed. As we shall see presently, a blue-eyed baby may possibly come from brown-eyed parents if recessive blue-eye genes chance to be retained in both sperm and egg, while the brown-eye genes are eliminated.

When will brown eyes appear in a baby? There are several possibilities depending upon the eye-color genes in the four sets of parental chromosomes and upon which two of these four sets enter into the union of the germ cells. Brown eyes are dominant to blue eyes, and therefore a parent with brown eyes must have come by them through

at least one set of chromosomes that carried brown-eye genes, while the other set may also have carried brown-eye genes or some recessive eye-color genes such as blue. Let us take several cases to find how these combinations might work out. We shall remember that the sets from the father are numbered 1 and 2, those from the mother, 3 and 4; the letter *B* will indicate the presence of a brown-eye group of genes and the letter *r* the presence of an eye-color group of genes, such as blue, which is recessive when paired with the brown-eye genes.

Case I

Brown-eyed father with gene groups 1*B* and 2*B*.

Brown-eyed mother with gene groups 3*B* and 4*B*.

Brown-eyed babe is assured, with paired gene groups *B* and *B* from any one of the four combinations: 1-3, 1-4, 2-3, 2-4. As far as color of eyes goes, this case is one of full-blood parents resulting in full-blood offspring.

Case II

Brown-eyed father (or mother) with gene groups 1*B* and 2*r*.

Brown-eyed mother (or father) with gene groups 3*B* and 4*B*.

Brown-eyed babe is assured because all possible combinations will contain at least one *B* group, and since this is dominant, the result will be brown eyes in the baby; but the genes will, on the average, distribute so as to result, in the long run, in 50 per cent of the children being full blood, and 50 per cent half blood. This is seen to be the case when we note the four possible combinations: 1*B*-3*B*, 1*B*-4*B*, 2*r*-3*B*, 2*r*-4*B*.

Case III

Brown-eyed father with 1*r* and 2*B*

Brown-eyed mother with 3*r* and 4*B*.

There are three chances out of four that the babe will be brown-eyed, for the combinations might be as follows:

1*r*-3*r*, which would result in a blue-eyed babe if the *r* groups both represent the blue eye color; 1*r*-4*B* and 2*B*-3*r*, two half bloods; 2*B*-4*B*, a full blood as far as eye color is concerned.

Case IV

The fourth case has nothing to do with brown eyes, but may be entered here to show the only other possible combination, that in which all the gene groups are recessive.

Blue-eyed father with gene groups 1*r* and 2*r*.

Blue-eyed mother with 3*r* and 4*r*.

Blue-eyed babe is assured since all sets of chromosomes carry only *r* groups of eye-color genes. The combinations are as follows: 1*r*-3*r*, 1*r*-4*r*, 2*r*-3*r*, 2*r*-4*r*.

Gregor Mendel, an Austrian monk who died in 1884, was interested in the crossing of green peas with yellow peas and of wrinkled peas with smooth peas. He was the first to discover that there was some order in the way in which peas pass on their characteristics from one generation to another. The significance of his discovery was not recognized at the time. He delivered a paper on his experiments before a local scientific society and went back to his experiments in the monastery garden; the world continued to face without explanation the evidence that unit characteristics are inherited, for children continued to be born with such incompatible characters as the beautiful eyes of the mother and the ugly nose of the father. Decades later, independent workers rediscovered the principles underlying the inheritance of unit characteristics; Mendel's work was then brought to light, and the principle that he discovered came to be known as *Mendel's law.* The essential operations of this law we have seen explained in the four cases given above.

Mendel's law is the basis for explaining much of inheritance but not all of it. Many characteristics seem to

follow the law, but not all of them do so. Then, too, there are other factors present in determining the nature of offspring, one of which is the influence of one group of genes upon other groups. We have noted this factor in operation in considering the dominant and recessive nature of brown-eye and blue-eye genes. It will be further illustrated as we

Mendel's Law in Operation.

The mating of pure black and splashed-white in P_1 produces the Blue Andulusian type of F_1, which in turn produces in F_2 a ratio of ¼ black, ½ Blue Andulusian, and ¼ splashed-white.

continue the study of the influence of the X chromosome which determines sex.

Sex-linked Characters and Secondary Sex Characters.—As has been previously shown, daughters receive an X chromosome from the mother and an X chromosome from the father; the presence of the two X chromosomes in the fertilized cell determines the female sex characters. The sons receive an X chromosome from the mother but none from the father. Naturally, this difference in inheritance has much to do with the development of the individual, not only in regard to the determination of sex but in other

respects that are related to the sex characteristics. The single X chromosome in the son, coming from the mother, will carry the influence of the maternal side of the union. The son will develop under the influence of genes of the X chromosome that may have come to the mother from either her mother or her father, the other X chromosome having been eliminated by polarization. The X-chromosome inheritance of sons is therefore not without male influence, but this influence is not from the paternal line. The maternal line thus seems to have an open field in a son's development as far as characteristics that arise from the genes of the X chromosome. As for the daughter, the genes of the X chromosomes, as with other chromosomes, are paired, and the developing characteristics depend upon which genes exercise the greater activity and dominance. The influence of genes of the X chromosome is not confined to a second X chromosome or an impotent Y chromosome but it also affects the activity of genes in other chromosomes. In other words, the new individual, both in the making and in the operation of genes after the making, is a product of the organization and the activity of all the genes, each group playing its part as a member of a whole in relation to other genes. Groups of genes exert their specific influences; these result in differentiated structures and specialized functions, but like all differentiations they are parts of a whole in which coordination is the rule. In such interaction, we find the basis for variety in eyes and hair and in other characteristics of the individual. The study of inheritance becomes extremely complex with the search for these interrelations of growth potentials.

Interaction of Genes and Cytoplasm.—In the interaction of groups of genes with other groups, the drama of inheritance merges into the drama of development. The life of the new organism becomes more and more an interplay of the inherited potentialities and the environmental factors. This interplay begins with the interaction of genes and cytoplasm in the maturing germ cells, particularly in the

egg cell which is much larger than the sperm cell because of the large body of cytoplasm that surrounds the nucleus. The cytoplasm contains neither a single gene nor any other material that is definitely responsible for any particular characteristic in the offspring; yet it nevertheless has an influence in determining the nature of the individual. Even at this early period of the development of the separate germ cells, we find operating in balanced relation the two factors that characterize all organic life, namely, the growth potentials, represented here by the genes, and the environment, represented here by the cytoplasm which serves in part as a reservoir of materials essential to growth. These materials are continuously replenished from the parent body, which in turn is dependent upon the relations maintained with the outer environment.

The genes of different individuals are very different and in contrast the cytoplasm of different individuals is not very different in newly formed cells. The cytoplasm changes through its interaction with the genes and with its relations with surrounding tissues. As it changes, the action of the genes changes, and then in turn the cytoplasm undergoes further change because of the changed activity of the genes—each step in development leading to mutual change which in turn leads to further change. Thus, we see the genes, not as arbitrary determiners of specific characteristics, but as a part of an organic development, making one with the immediate environment of cytoplasm, and thence with the adjoining tissues and blood stream, and through these with the outer world from which ultimately come the necessities of life. In bone cells, we see the differentiated expression of inherited potentials, varying in different parts of the bony structure according to their function. So with muscle cells of various kinds, and with all the cells of the body, each kind giving expression to potentialities, but giving expression to these potentials in relation to other cells which are cooperating in a balanced whole of complex activities of the organism.

Looked at in one way, the action of the genes may be seen as individuated in character, one group determining eye color, other groups determining other characteristics. On the other hand, the action of the genes may be seen as dependent upon their relations with other genes and with the environment, internal and external. The development of chromosomes and genes in the maturing germ cell, their selection during the process of reduction, and their union in the fertilized cell to form the pairs essential for the creation of the new individual—these developments are all dependent upon the interrelations within a larger organic whole which in turn is intimately related to environment. As we have seen in our earlier study, this interplay of factors of inherited potentials and relations between differentiated parts and environment persists in the life of the developing and the matured organism.

Heredity and Environment.—In scientific circles, there has been, and continues to be, controversy concerning the relative influence of heredity and environment in the lives of men and other organisms. It is understandable that those who contend for the influence of heredity should be intrigued with the way in which unit characteristics seem to be handed down from one generation to another. The observations in everyday life of similarities in parents and children are persistent witnesses for this side of the question. On the other hand, it is equally apparent that environmental conditions of many kinds are influential in determining the development of an individual. Differences in food and climate and parental care, we know, may make significant differences in our lives. Controversy exists not only in regard to these more obvious phases of the problem, but also in regard to the question of whether changes in the individual that are due to environment will be transmitted to following generations. Much experimentation has been done in attempting to solve this question of the transmission of acquired characteristics; but the question still persists, and the experimentation still con-

tinues. It may be said that the evidence which points to the transmission of acquired characteristics is rather meager. Nature persists from generation to generation in much the same general channels, resulting in organisms that are readily identified as belonging to a particular species, genus, and family. Basic patterns change, but apparently not because of environmental influences that are transmitted to successive generations.

Our present concern with this controversy is very practical. We know that heredity puts limitations upon every one of us; it makes it easy for one characteristic to develop and closes the doors, to greater or less degree, to the development of other abilities. The fact that human beings are different implies limitations of various kinds, many of which lead back to initial hereditary differences. As we have found in our study of inheritance, nature sees to it that practically no two individuals are born alike. Our study of inheritances gives us an understanding of how the differences in inherited abilities arise. The inherited growth potentials lay the foundation for the development of the individual, but human behavior is more than a set of basic patterns. It is well that we have an understanding of how inheritance makes people different, but the most significant aspect of human nature remains its remarkable capacity for the modification of behavior and the creation of new patterns of behavior. The importance of man's learned behavior is found in the way in which he has created much of the environment in which he lives. He controls his supply of food; he at times controls the temperature and the humidity of the very air he breathes. In addition to these basic necessities of life, we find a complex world of governments and religions and customs and languages and other social controls which tend to determine the life of an individual but which at the same time release him from the cares of mere existence so that he may become more of a distinctive personality than could ever have been guessed from the original inherited differences with

which he came into the world. We need to understand original nature, but our chief concern remains that of making use of the modifiability which is one of our biological inheritances. Life at all levels is essentially related both to the basic organism and to the environment; our study may well remain that of how these two factors cooperate. The practical problem is one of coordinating hereditary and environmental influences rather than the setting of one of these factors against the other.

Summary: Respect for Individuality.—We hear much about respect for personality, respect for those that are older, respect for our peers, and respect for the personality of children. One of the practical results of a study of inheritance should be the respect for individuality which may be expected to come from an understanding of the ways in which nature has provided that we should be different. Although nature has provided for the common pattern of human nature, she has also seen to it that variation shall be the rule. Out of an understanding of the scheme of inheritance, there should come an acceptance of the fact that each person is an individual; there should come constructive attitudes which set us to looking sympathetically for the differences in human nature that the scheme of inheritance provides.

Too often it seems to be the intent of parents and teachers to bring individuals into a common mold. The understanding of nature's scheme of inheritance should put such an attitude in question. Better far to view the ways of nature in their entirety, for by doing so we may find the basis for a sound point of view with respect to our wide range of differences. Let us note the main outlines of such a point of view.

Nature provides that we shall be different, but it also provides that we shall be sufficiently alike to have a common basis for social adjustments. Human beings are gifted with a remarkable capacity for adaptations on an intelligent level, but these lead naturally to greater differences rather

than to conformity. There is room for differences in our complex social and industrial life; this life thrives on new ideas that arise from individuals who are living and thinking differently. Finally, nature provides the principle in the great scheme of differentiation which shows that individuality may be attained in a community of organic relations. The differentiated parts of a complex organism emerge from that which is common; but by gaining this specialization of function and individuality of structure, new patterns of individualized behavior are contributed to the total organism. The emergence of such organic individuality is not to the detriment of other parts. It is through the individuation of parts that other parts are freed to gain individuality; it is through such individuality that the total behavior is raised to higher levels; it is on these higher levels that the wider possibilities of life are to be found.

Thus may parents and teachers and citizens look upon the individuals born into this world; thus may they look upon the developing personalities which build upon the inherited differences the still greater differences that arise from variations in experience and learning. Such a point of view gives due respect both to those things which provide the common elements in our life and to the variations in inherited individuality and developing personality. In the chapters that follow, we are concerned with the differences in such personalities. The pattern for our understanding is based on the fact that we are born different and that differences in experience make us still more different. We do not develop worth-while personalities in isolation; we shall find that personality development is essentially a social process in which individuals develop in relation to other individuals.

SUGGESTIONS FOR NOTEBOOK AND BULLETIN BOARD

1. The re-sorting and elimination of chromosomes in the maturation of germ cells is shown in the differences between identical

and fraternal twins. Find pictures of these two types of twins, and supplement each with suitable captions and diagrammatical illustrations of germ cells which will make plain the cause of identical twins being so much alike and of fraternal twins being so different.

2. Consult the catalogue of the library to which you have access, and select a text on eugenics. From such a text, make a list of unit characters that seem to be definitely determined as following Mendel's law. Make another list of unit characters that seem not to follow Mendel's law. In making such lists, one becomes aware of the work going on among eugenists in their efforts to chart the field of inheritance.

DIARY OF YOUR OBSERVATIONS

1. Make a list of a dozen or more of the characteristics of some child, perhaps of yourself, that can be definitely identified in one or the other of the parents or in one of the grandparents. These unit characters may be of the nature of physical structures, or behavior patterns, or abilities such as musical or artistic talents.
2. The first suggestion for your notebook, made above, might be worked out on the basis of actual observation of identical and fraternal twins.

SUGGESTED READING

1. An interesting news item found in *Time*, Feb. 24, 1936, shows the continued interest in the work Mendel started and the esteem in which this work is held in scientific circles.

   Mendel's law comes from an interesting period of scientific history, an account of which may be found in Holmes, S. J., *Human Genetics and Its Social Import*, Chap. 3 (McGraw-Hill Book Company, Inc., 1936). In the same volume are other chapters bearing on our study: 1. "Heredity and Its Cellular Basis"; 4. "Heredity and Sex"; 5. "Interaction of Factors"; 6. "The Linkage of Factors."
2. It is recommended that further reading be done on the changes that take place in the maturation of germ cells. A well-written source for this reading is Jennings, H. S., *The Biological Basis of Human Nature* (W. W. Norton & Company, Inc.,

1930). The following page references and topics will aid in finding material on particular phases of inheritance:

a. On page 73 is a general statement of the problem of inheritance. A quotation from this page may be selected for your notebook.

b. On pages 76 and following are further details on the maturation of the germ cells.

c. On pages 193 and following will be found a discussion of the influence of genes on genes in the development of the organism.

d. On pages 198 and following is an interesting and well-balanced discussion on the coordination of the growth potentials of genes and of environmental factors in the maturation of the germ cells and in the subsequent development of the individual.

Chapter Fourteen

Interpreting Individual Differences

There is value in understanding how individuals come to be different through inheritance, and this is fully matched by the very practical value of knowing how to interpret what we find before us. Living with individuals, we are called upon to evaluate their different abilities and their various achievements. Jimmie, for example, comes home reporting 20 words spelled correctly in a list of 30. Is this good, bad, or mediocre? Our interpretation depends of course upon how old Jimmie is and how difficult the words are and upon other matters such as the opportunity he has had to learn the particular words in the list. He reports 30 right answers in a test of 50 problems in arithmetic computation. Is this better than his achievement in spelling? The sensible thing to do will be to judge each performance of Jimmie's with reference to the performances of other children of similar age and schooling. What did the other children of his class do, and what do children of similar age in other schools do when given the test under similar conditions?

The Basis for Thinking "How Much."—It is possible to organize our ways of thinking about the distribution of abilities of children in general so that we can interpret the performance of an individual like Jimmie. Jimmie's scores in spelling and arithmetic and reading mean little or nothing until they are seen in relation to the achievement

of other boys and girls. Knowing the distribution of scores of other boys and girls on the same tests or on equivalent tests, there are several ways in which we may interpret Jimmie's achievement. We may note that his score in spelling places him fifth from the bottom of the 30 youngsters in his class, his score in arithmetic places him slightly below the middle of the same group, and his reading score places him tenth from the top, when the 30 scores are placed in rank order. However, this method of placing the scores or measures of the individuals of a group in rank order makes it possible to say that one score is better than another, but it does not give a very accurate idea of how much better one is than another.

A better method of interpreting the significance of differences is to note where all the scores of the group fall on a scale and then where Jimmie's score falls. For example, if we wish to interpret Jimmie's 4 feet 6 inches of height, we find first how boys of his age are distributed on a scale of height; and then having located Jimmie's score on this scale not only can we interpret it with reference to scores of others of the group, but we can also say that it is so much above or below the average score on the scale. Something like this procedure is implied in giving children grades of A, B, C, D, E. The grade C is generally interpreted as being given to approximately the middle 40 per cent of a group, but C also stands for average ability on the scale. B and D are grades representing abilities next removed above and below the average on the scale, and each includes about 20 per cent of the group; A and E, the grades at the two extremes of the scale, are each thought of as applying to about 10 per cent of the group. More precise interpretation gives the percentages normally distributed over five points on the scale as approximately 7, 24, 38, 24, 7.

It is common knowledge that, in groups representing the general run of human abilities, there are relatively few individuals to be found at the two extremes of a distribution, many found near the middle, and fewer in the inter-

mediate B and D positions on the scale. In general-run or unselected groups, abilities of all sorts persist in distributing themselves in this characteristic manner. For example, the measures of height of a group of 60 typical ten-year-old boys may be expected to distribute somewhat as indicated in the figure below. In the figure, each boy is represented by a B and his height is indicated by the placement of the B over a particular point on the scale. For this group of 60 boys the scale should run from 47 inches to 61 inches.

							B							
						B	B	B						
					B	B	B	B						
					B	B	B	B	B					
					B	B	B	B	B					
				B	B	B	B	B	B	B				
			B	B	B	B	B	B	B	B	B			
		B	B	B	B	B	B	B	B	B	B	B		
B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
47	48	49	50	51	52	53	54	55	56	57	58	59	60	61

DISTRIBUTION ON A HEIGHT SCALE

Distribution of a group of ten-year-old boys on a scale of height in inch units. The number of boys at each point on the scale is indicated by the number of B's in the respective columns.

Comparable Units of Measure.—How shall we make a comparison of Jimmie's height and his weight? It is plain that feet and inches cannot be compared directly with pounds and ounces. In some way, we must refer Jimmie's height to some standard and then his weight to the same standard if we are to decide whether he is tall for his weight or if his weight and height are developing together on somewhat equal terms. We do exactly this in our everyday judgments in such matters. We may not be very exact in such judgments, but they have the same basis as the more exact statistical procedures; both evaluate the height and weight of the individual with reference to that of other individuals of the same age. If we say that Jimmie is heavy

for his height, we mean, that compared with the average development of children of his age, he has grown faster in weight than he has in height.

Obviously, our thinking about abilities and achievements of individuals would be aided if inches and pounds and other measures were to be converted to some common unit of measure. Our everyday experience brings us into touch with just such a measure when teachers give grades such as A, B, C, D, and E to indicate merit in spelling, arithmetic, and other subjects. In the same way, we might say that Jimmie is B in weight and C in height. In doing this, we are able to compare directly Jimmie's height and weight and bring feet and inches into terms that are comparable with pounds and ounces. This has been done by bringing both these measures into relation with a group of children of the same age; for the B in weight means that Jimmie is above the average of such a group, and the C in height means that Jimmie is near the average of such a group in this respect. The grades A, B, C, D, and E are rightly called *comparable measures*, for they make possible a direct comparison of two characteristics that are quite different in their nature and commonly measured in quite different units. One can appreciate the value of this procedure of converting raw scores into comparable measures if one tries to think of the relative values to be put on widely different characteristics, such, for example, as Jimmie's ability to discriminate between tones and to high jump, or his height and his ability to read.

It is our purpose here to get a clearer understanding of the more precise methods of making comparisons between different abilities and performances, for such understanding will lead to clearer thinking concerning the values to be put on various abilities and characteristics of human nature. Before we can proceed far in evaluating the significance of individual differences, we find the need for a technique of interpreting the individual in terms of other individuals.

Converting Raw Scores into Comparable Measures.—The A, B, C, D, and E grades, which teachers use so often, have, or should have, a definite meaning. The more definite their meaning, the clearer the thinking in which they are used. The grade C should stand for abilities that are average for children of various age or grade levels. If we find that Jimmie is 54 inches in height and know that boys of his age are distributed in height in the manner of unselected groups, we can safely say that the 54 inches can be converted to a C grade or score. The question arises, however, as to what grade or comparable measure is to be given to a boy of Jimmie's age who is 56 inches in height, or to one who is 60 inches in height, or to one who is 50 inches in height. Obviously we should use some precise method to determine the division points on the scale that divide A grades or measures from the B measures, B from C, C from D, and D from E.

Two procedures are necessary to determine what raw scores shall be interpreted as belonging to the respective A, B, C, D, and E measures. (1) There must be a point of reference, a place of beginning; (2) we must determine the number of raw scores to be assigned to each comparable unit. The easiest way out of the need for a point of beginning might appear to be that of beginning at one end of the scale or the other, but such a procedure is immediately seen to be questionable when we realize that the ends of the scale may be determined by an extremely tall or short boy who might chance to be one of the group. In other words, the extremes of a distribution are very unstable points of reference, both in determining a sound statistical starting point and as a point of reference from which to do our thinking. One needs only to observe people drawing conclusions from some unusual case to appreciate the fact that conclusions should be made on the basis of more than one human being, particularly when this one has gained our attention because he is unusual. Human nature is better represented by the greater number in the middle of

the distribution, and statistically a more stable point of reference can be found there than at either of the extremes of the distribution. Points of reference taken at the middle of the distribution are rightly called measures of *central tendency*, and this name points to the fact that this measure represents the group.

Two commonly used measures of central tendency are the *mean* and the *median*. The mean is computed by adding together all the scores of a distribution and dividing by the number of cases in the group. The median is the value of the midmost measure of a series of scores arranged in rank order. If 11 boys were placed in rank order with the shorter at one end and the others in the order of their increasing height, one need but take the height of the sixth boy to have the median for the group. In different situations, one of these measures of central tendency may have an advantage over the other. For our present purposes, we shall use the mean as the measure of central tendency and the point of reference for interpreting individual scores.

After the mean is computed, the next step in converting raw scores to comparable measures is to determine the number of raw scores that shall be included in each of the A, B, C, D, and E units. A simple method seems to suggest itself for solving this problem; it would be very easy to divide the total range of scores of the group into five equal parts. If we have a distribution such as that for the 60 boys given on page 380, this method seems to work out very nicely, for there are 15 raw-score points on the scale and 3 inches could be readily assigned to each of the five grades or comparable units of measure. Thus heights of 47, 48, and 49 inches could be interpreted as of E grade, and the next 3 inches could be interpreted as of D grade, etc., to convert the entire 15 inches of the scale into comparable units. All distributions are not so easily adapted to this simple procedure, however, and, what is more serious, we have unwittingly made one or the other of the extremes

the point of reference by this too simple procedure. In distributions that have unusually low or high scores, the total range of scores would be too great to be truly representative of human nature, and as a result the comparable scores would likewise not be truly representative. The measure that we wish is one that will represent the way in which representative groups are distributed; and, if there be unusually high or low cases, they should be balanced by the larger number of cases at other points on the scale.

One measure of central tendency that is commonly used is the *standard deviation*. The statistical procedure for determining it tends to restrict the influence of unusual cases but gives them a chance to be represented in the resulting measure. The procedure is as follows: (1) Find how far the score of each individual in the distribution is from the mean which is used as a point of reference. (2) Square these deviations. (3) Get the mean of these squared deviations by adding them together and dividing by the number of scores. (4) Get the square root of this mean, which will give the standard deviation. The standard deviation is sometimes called *sigma* for short; it is also referred to as the *mean square deviation*, a name appropriate to the procedure by which it is determined.

The method of squaring the deviations, getting the mean of the squares, and then taking the square root of this mean tends to give a representative measure of deviation because it restricts the influence of extreme scores. Another measure of deviation that is little used is the *average deviation*, which is computed by merely adding the deviations and dividing by the number of cases. This measure lacks the stabilizing influence that is found in the procedure of squaring used in computing the standard deviation.

A third measure of deviation is often used, not so much for converting raw scores to comparable measures as for the purpose of general interpretation of distributions. This third measure is the *quartile deviation*. It is half the distance on the scale covered by the middle 50 per cent of the cases.

The quartile deviation is computed by first finding the points on the scale that separate the lower and the upper 25 per cent of the cases from the 50 per cent of cases in the middle of the distribution, then subtracting the score representing the lower of these points from the score representing the higher, and dividing the difference by 2. The quartile deviation eliminates the influence of the extreme cases, as does the standard deviation.

The standard deviation has the advantage of giving measures that provide a sound statistical basis for the five-point system represented in the common use of A, B, C, D, and E grades. Using the mean as the point of beginning, the upper and lower limits of the C grade are found, the lower limit being one-half sigma below and the upper limit one-half sigma above the mean. The upper limit of the C grade is the lower limit of the B grade, whose upper limit is a full sigma above its lower limit. The limits of the A grade start with the upper limit of the B grade and extend to one sigma above that point. The upper limit of the D grade is the lower limit of the C grade, and the lower limit of the D grade is a full sigma below this point on the scale. The E grade extends from the lower limit of the D grade downward a full sigma. Thus we have the scale converted from raw scores, whether they may be of inches, pounds, words spelled rightly, or number of problems solved correctly, into the same type of units. These sigma units are statistically sound; they have a common meaning because of their reference to groups of human beings sufficiently large to give significance to the score of a single individual. Extreme cases may, of course, lie below or above the limits of the five-sigma scale, but such occurrences need give us no great concern, for the basis is laid for interpreting such scores just as it is for those within the range of the five-sigma units.

The reader may at this time have little or no use for these statistical procedures, but there is point and value in knowing that such procedures are commonly employed. Aside

from their actual use, the comparable measures give us a method of thinking about individual differences that is of great value. Knowing the distribution of many children on a definite scale we are able to think of the abilities and behavior of a given child with greater accuracy and better understanding. Understanding how nature tends to distribute original capacities and characteristics and how living and learning still further distribute abilities and performances, not only do we get a better understanding of human nature in general, but we have a sound basis on which to interpret the behavior of children. In other words, these statistical procedures represent methods of organizing our facts so that we can think better concerning the variations that confront us in many of the characteristics and abilities of human beings. We frequently make comparisons of abilities and conclude that someone is better in this particular than in that. Comparable measures give us a more precise basis on which to make such comparisons.

Relative Significance of Different Abilities.—We commonly judge our fellow human beings by their behavior in ordinary affairs, saying this one is bright, this one dull, and this one mediocre. Usually, such judgments are hasty, and the judgment of today may be reversed tomorrow, the change being due more to the way judgment is made than to any change in the ability judged. We make these judgments about many different abilities and performances. Judged by his reading, Jimmie is a bright boy, but judged by his spelling he is of rather poor ability. He is capable in physical coordination and strength, but he has trouble carrying a tune. A multiplicity of inherited genes, a multiplicity of factors of development, a multiplicity of things learned, and a multiplicity of purposes and cross-purposes become involved in the making of a Jimmie.

It is interesting to note the various abilities and performances commonly used as a basis for judging children. We say, for example, that Jimmie is in general a rather

bright boy. By this we mean that he reacts and adapts to new situations rather quickly and successfully. Knowing that Jimmie is bright, we may be prone to excuse his poor spelling and his poor music and his poor handwriting by

(*Courtesy of Los Angeles Public Schools.*)

Four Twelve-year Olds; the Same in Age but Different in Physical Characteristics and in Other Important Respects.

saying that he does not happen to be interested in these things. We may even condone such shortcomings by pointing out that many intelligent and successful people live happy and fruitful lives with little ability in spelling and music. We commonly designate as special abilities such things as spelling and handwriting and music and art and thus set

them up as different from more general abilities such as reading, figuring, solving problems, measuring lumber, weighing groceries, and other performances of our workaday world of school and business. In designating some of these abilities as special, we do not discount their importance and desirability, for through the development and use of one or more of them many people earn their living, gain fame, and give much pleasure to others. The point is, we do judge our fellow beings with respect to this and that and the other thing, and some of these abilities we think of as general and others we call special.

Complexity of Abilities in Human Behavior.—This division of abilities and performances into special and general fields is of course relative. There are many factors that enter into even the simpler things we do. It is the combination of different abilities that makes the difference in performance. For example, many people do not possess the abilities necessary for beautiful singing. They may be able to read music notation and the words that are to be sung and to interpret these intelligently and sympathetically; but if they are deficient in the ability to recognize differences in pitch or if their vocal organs are deficient in native quality or in training, the performance suffers accordingly. It should be noted, however, that in the field of music there is a place for the abilities which we think of as general; in interpreting the words sung and in reading the music and giving it life and power, the musician makes use of much of insight and understanding that is common to the general experiences of life.

If we turn again to the learning done by the subjects of Bryan and Harter, of Book, or of Ruger[1] and review the intricate patterns of behavior in telegraphy and typing and puzzle solving, we find that each involves many kinds and many levels of habits, attitudes, and interests. Lower orders of habits are built into the framework both of higher orders of habits and of purposes through which they are

[1] Chap. X, pp. 272*f*; Chap. XII, pp. 344*f*.

all patterned into a whole of behavior. Variations in different abilities have their bearing upon the whole, and because of the individual differences that arise from inheritance and training, we naturally find that some subjects can make much greater progress in the total performance than can others.

We may look upon reading as made up of many abilities, such as the recognition of the meaning of words, habits of following the lines speedily and accurately and of taking in shorter or longer spans of words in the line at a single fixation of the eyes, and the ability of coordinating all these into a total performance that is both orderly and persistent and in keeping with varied purposes of reading. The variety of abilities that go into the experience of reading is recognized, in part at least, by the different ways in which reading ability is measured. There are tests for measuring ability to recognize the meaning of words, to read sentences, and to read paragraphs. Skill in silent and in oral reading is measured; speed of reading is measured; and the level of difficulty of the performance is measured. There are tests to measure the ability to read for general significance, to note details, to predict outcomes; and there are tests of reading with respect to other purposes. Speed in reading tends in general to agree with ability to comprehend; that is, the faster readers are more likely to be the better readers, and the slower readers are apt to be the poorer in ability to comprehend what is read. This of course does not mean that we may be assured that Jane, or any other particular child, will have the same level of ability in comprehension and speed and other aspects of reading. We know reading to be an exceedingly complex pattern of behavior, involving various abilities which combine in various ways to make the reading of each of us what it is.

Arithmetic, like reading, is measured in several ways. Two general classifications may be made of arithmetic tests, those measuring various types of computations and those measuring the ability to solve problems. Naturally

and obviously, these two abilities are related, for one cannot reason in solving a problem and arrive at any answer without actually using computations. There evidently are many differences in the nature of computation and of reasoning in arithmetic, as we see when we learn that reasoning has greater general agreement with comprehension in reading than it does with computation in arithmetic. Relations of number and quantity are involved in many types of situations in school and in life, and it is to be expected that they reach over into many fields that we do not recognize and name as arithmetic.

General Intelligence.—What are the characteristics that warrant our statement that Jimmie is a bright boy but that another boy is dull? All kinds of everyday behavior furnish a basis for the judgments, such as Jimmie's getting the jam from the cupboard, his ability to read, and the way he ingeniously repairs his bicycle. His being rated as bright is based not only on the fact that he can do these things, but also on the way he does them. Value is put on the quality found in most of his activity. The emphasis upon the quality of learning has been used as a basis for judging levels of intelligence. Instead of centering attention in the great number of specific abilities that go to make up reading, arithmetic, and other performances, the search has been for a few significant characteristics which are revealed in all these performances. Situations chosen for determining differences in general intelligence may call for the learning of something new or novel, or they may be chosen to discover the character of learning that has already taken place; in either case, it is the quality of the performance that is sought. These qualities are those which are natural to the learning process, such as the ability to recognize problems in situations that confront us, the ability to persist in their solution, and the adaptability that is evidenced in the learner's seeing and following new cues.

Binet, working in France in the first decade of the century, was the first to attempt a definite organization of test

materials for the measurement of intelligence. He devised his test situations to reveal just such characteristics of learning as are noted above. He was intent on discovering the subject's capacity to learn and thought that he could best do this by determining the quality of the learning process. The situations used and what was learned were a means of revealing the quality that went into the learning. His point of view is expressed by Terman as follows: "Binet's conception of intelligence emphasizes three characteristics of the thought process: (1) its tendency to take and maintain direction, (2) the capacity to make adaptations for the purpose of attaining a desired end, and (3) the power of auto-criticism."[1]

Binet's point of view is in keeping with the nature of human learning and in harmony with a common-sense view of experience. Thought and behavior are not effective unless they take and maintain direction. Insight and purpose develop together in the process of adaptation. Goals are the product of the changing patterns of thought through which they become progressively clarified. These progressive changes imply a sensing of direction, as thought and action progress toward the solution of the problem. This sensing of right direction is what Binet calls *auto-criticism.* Jimmie in his jam getting was rightly credited with an intelligent exploit. The situation was novel, and for a boy of his age it presented a real challenge. The situation called for the qualities that Binet held as essential to intelligent behavior; direction was taken and maintained, and adaptations of moving chairs and climbing to cupboard ledge were made in keeping with the desired end. The autocritical function is implied in the right choice of means to ends; we observe it pointedly in operation as Jimmie finds himself on the ledge and takes the safer route of calling his mother rather than risking a fall if he attempts the more difficult climb down.

[1] Terman, L. M., and others, *Stanford Revision of the Binet Scale*, p. 147, Warwick and York, 1917.

Types of Situations for Intelligence Tests.—Naturally, the selection and control of the situations through which intelligence is tested will be such as to involve the characteristics that are thought to be essential to intelligent behavior. Some test situations involve one of these characteristics perhaps more than others, but all are present in greater or less degree in the adaptations to the situations presented. Test situations that call for following directions appear at several age levels of the new revision[1] of the Stanford-Binet examination. This test is given to single individuals, and opportunity is afforded to note the adjustments that take place in responding to the conditions set up. Thus, at the two, three and one-half, and four and one-half year levels children are asked to execute simple directions. They are asked to repeat digits, sometimes only three or four, as 5–7–4, and then six or more at more advanced years. Hearing the digits in rhythmic sequence at intervals of 1 second, the child is challenged with a situation that calls for attention and for organizing his purposes to the needs of the situation. The total situation must be comprehended. He must orient himself in a purposeful manner. He must persist in listening carefully to the numbers, hold them in memory, and finally give them back in the order they came to him.

Such situations as those just noted require facility and adaptability of the thought processes, but there are other tests that seem more pointedly to demand these qualities. At the four and one-half year level, a child may be asked to complete a sentence spoken to him, such as, "Brother is a boy; sister is a . . . . " At the eight-year level, he is asked whether an orange and an apple are alike or different, and in what way they are so. At the ten-year level he is asked to name as many different words as possible in 1 minute. The reader might try this himself, and if he does he will sense what is meant by mental facility.

[1] Terman, L. M., and Maud A. Merrill, *Measuring Intelligence*, Houghton Mifflin Company, 1937.

A little consideration tells us that this facility is based very definitely upon the way in which we have organized our thought processes in the past; the way in which one word leads to another is not a hit-or-miss matter, as one might at first suppose.

Language, oral and printed, is involved in such test situations, and in the understanding and use of words the facility of thought processes and the past organization of experience are repeatedly put to a test. Many of the tests purposely make success dependent upon language. In one form or another, vocabulary tests that contain words scaled from easy to difficult are common to intelligence tests. The intent is to determine the level of concept formation that has evolved in the child's life. Concepts and generalizations are key factors in the increased complexity of thought that is essential to higher levels of intelligence, and such tests are therefore decidedly in point with the purpose of measuring general mental ability.

Allied to the tests involving levels or degrees of abstraction in concepts are those which involve social situations demanding judgment of what is best to be done under given circumstances. Such tests call for facility in organizing experience to understand the test situation itself, but the major intent is to discover how well the child has previously become adjusted to his environment. Other test items deal more directly with the processes by which concepts are formed, as in the one already mentioned in which the child is asked if an orange and an apple are alike or different. One test asks the child to discover the absurdities in several situations that are presented to him. In another test, he is asked to tell what a fable teaches.

The autocritical function is of course implied in every test situation; the following of a simple direction, the response to questions, or the statement of a judgment calls for more or less discrimination and sensitivity to fitness and accuracy. In some of the tests, this quality is plainly demanded. The plan-of-search test, which appears at the

thirteen-year level in the new revision of the Stanford-Binet examination, is a good example. This test presents the subject with a circular diagram; he is told it represents a big field in which he is supposed to have lost his purse containing a lot of money. He is asked to take a pencil, start at the gate, and trace the route he would follow so that he would be sure not to miss the purse. This test calls for setting a goal, making a plan, and following it through; it also calls for facility in the thought processes necessary to devise the means that are adequate for the conditions of the situation and for the end in view. An examination of many samples of responses makes it clear that a child's sensitivity to the adequacy of his plan is a very significant factor in the performance.

Standardizing Procedures in Testing.—In a sense, each item in any individual test is a carefully controlled experiment, both in the giving of the test and in the interpretation of the results. Each time the test is given, it must be presented and the results interpreted as the directions indicate. The necessity for this standardized procedure is apparent when we realize that the score which one child obtains can be interpreted and used only by comparing it with the results obtained by other children. We want to know what Jane and Jimmie will do when the test situations are presented to them just as they have been presented to a large number of other children. We must likewise interpret their responses in the same definite way in which the responses of other children have been interpreted. It would be nonsense to vary the presentation of test situations or the interpretation of the responses of one child as compared with another. The procedures in giving and scoring each item of the tests are therefore carefully determined and described so that the results may have, as far as possible, the same significance. The advantage of giving the test to one child at a time is that the attention of the tester may be centered in controlling the conditions of the test. The oral responses that are received of course vary widely, and

the tester must be carefully trained in order that these responses may be properly interpreted.

Group Tests of Intelligence.—Following the earlier development of individual tests of intelligence, group tests of intelligence were devised. A new set of problems is presented in the giving and scoring of such tests. In the individual test, the tester is able to converse with the individual child, gain his confidence, and establish good conditions for the test. In the group test, this flexibility is sacrificed to the necessity of preparing all the children in the group for the test. Moreover, the conditions must be similar, not only for the children in a given group, but for one group as compared with another.

(*Courtesy of Los Angeles Public Schools.*)
The Individual Test Can Be Carefully Controlled; the Results Provide the Basis for Wise Guidance.

In scoring a group test, the necessity of uniformity again limits consideration for individuals taking the test. The types of written responses must necessarily be such as can

be definitely interpreted and scored as right or wrong. The difference between the individual test and the group test will be apparent to the reader who investigates both types. It should be apparent that whichever type is used the standard procedures of giving and scoring are to be carefully followed if the results are to be useful.

Naturally, the results from a group test cannot be so reliable as those from an individual test. The limitations of group tests are recognized, and the results are used principally to indicate the status of groups of children rather than individual children of the group. The average of many children of a group may be a very stable index of the group, whereas the scores of the individuals might be quite unreliable. On the other hand, there are some group tests of intelligence which are sufficiently extensive and well constructed so that their results may be used with some assurance in evaluating the relative ability of individual children within the group.

What Is Mental Age?—Binet in his first revision of his original scale, made in 1908, arranged the items in groups which he allocated to given ages. The same plan was followed in his 1911 revision, and it has been followed in most of the individual scales that have grown out of the Binet scale. In the earlier age levels of the Stanford-Binet scale there are 12 tests to each year, with a value of one month to each test, and at the higher age levels fewer tests are used, with a corresponding greater value in months given to each. Thus, the results are directly interpreted in years and months. In giving the Stanford-Binet, for example, if a child approximately eight years of age chronologically is tested, the test begins by giving the items at the seven-, or perhaps at the six-year level, it being necessary to include a year at which all tests of that year are passed. The testing then proceeds to succeeding age levels until the child is not able to pass any test of a given year. The final score is obtained by adding years and months together to make what is called the *mental age*. If all the six-year-level tests

have been passed, the summing begins with a credit of six years and no months, to which we may add, for example, ten months at the seven-year level, ten months at the eight-year level, eight months at the nine-year level, six months at the ten-year level, and two months at the eleven-year level. It is thus necessary to add to the six-year level a total of thirty-six months or three years, giving a mental age of nine years.

Let us suppose that a mental age of ten years resulted from a test given Jimmie when he was eight years of age. Just what do we have in this information, and what can we do with it? Let us note some of the facts that make this result significant. It has been arrived at by interpreting Jimmie's responses to many situations; Jimmie has had a fair chance to show what he can do. These situations have been carefully devised for the purpose of revealing the qualities that are essential to good thinking and learning. They have been selected from many possible situations, and they have been placed at certain age levels after considering the responses of many children. They have been standardized by giving them to many children under the same carefully controlled conditions that were used in testing Jimmie. We are able to call the ten-year score that Jimmie obtained from the test his mental age, because he has shown the ability to think and to adapt to situations in a manner characteristic of the average ten-year-old child. We have used many types of situations in securing this result, and we therefore credit him, not with any one of various abilities, but with a general ability, with a level of general intelligence. What we have is definite, objective evidence of the very same quality of human nature that the neighbors have in mind when they say that Jimmie is a bright boy. The judgment based on the test is better than that of the neighbors only because the responses on which it is based have been selected and evaluated in a way that makes them more definitely comparable to the behavior of other children. Jimmie's responses result in a definite

score, the mental age, rather than in the indefinite judgment of "bright boy." Neither the judgment of the neighbors based on casual observation nor the judgment based upon the test situations is infallible. The neighbors will perhaps want to change their judgment after observing Jimmie more. We may want to test Jimmie again, let us say in 2 years; or perhaps we may wish to use the Herring scale[1] or the Kuhlman tests[2] to verify the results which we have obtained from the Stanford scale.

The Intelligence Quotient.—Let us turn again to Jimmie and see what we know about him that we perhaps did not know before. Let us see what differences might arise in our thinking about him as a result of this mental age of ten years. First, we note that he is eight years old according to the calendar; so in that life span of eight years he has added two years to the development of the average child of eight to give himself a mental stature of ten years. He is eight in years lived, but he can think and learn on the level of the average child of ten, who has lived two years more than he. He has developed to a ten-year level in eight years, and the two years of acceleration represent 25 per cent of the eight years that he has lived. We say therefore that Jimmie's intelligence quotient is 125, meaning that his mental age is 125 per cent of his chronological age. This relation is commonly expressed in the following equation in which I.Q. stands for intelligence quotient, M.A. stands for mental age, and C.A. stands for chronological age.

$$\text{I.Q.} = \frac{\text{M.A.}}{\text{C.A.}}$$

The Probable Error of Measures.—In the results of tests will be reflected the inaccuracies in the making of the tests and the variations in the giving and interpretation

[1] Herring, John P., *Herring Revision of the Simon-Binet Scale*, World Book Company, 1924.

[2] Kuhlman, F., *Handbook of Mental Tests*, Warwick and York, 1922.

of the tests, and the results will reflect the differences in the zest a child has for taking a particular test. There is always a margin of inaccuracy in the results of tests; the term given to such inaccuracy is the *probable error*. Kelley[1] has chosen to characterize probable errors as "ubiquitous," to keep us constantly reminded that we are at all times and on all occasions dealing with varying factors of test making, test giving, test scoring, and test taking. We are at all times confronted with limitations in controlling our experiments, and the results cannot be precisely comparable. There are ways of measuring this probable error, either by comparison of the results of tests given to the same subjects at different times or of those from different forms of the test given at the same time. Thus, we know that we may expect the intelligence quotients based on individual tests to have a probable error of about 5, meaning that the chances are even that the quotient obtained on a first test will vary from the quotient obtained from another giving of the test by about five points. Among a large number of individuals to whom the test has been given twice, it is to be expected that the second result will in some cases be lower than the first, though in other cases it will be higher than the first. A few cases will be much lower on the second test than on the first, and a few will be much higher on the second test than the first; but the distribution of the differences will form a curve that approximates that of a normal distribution, with the greater number of the cases showing a relatively small amount of change.

Probable Errors with Reference to True Scores.—It is well to know the probable error of a score in relation to a single other giving of the test, but to be most useful probable errors should show how much the result of a single test that we have before us is apt to vary from a *true score*. A true score, as it is used in statistical procedure, is conceived to be the average of a large number of scores obtained by

[1] Kelley, Truman L., *Interpretation of Educational Measurements*, World Book Company, 1927.

giving a test repeatedly. To some degree a true score is theoretical, but it is nevertheless statistically sound, and the probable error with reference to it can be readily computed. Let us note how we would use such a probable error. When we have given an achievement test covering many subjects, we may secure a total score, and from the table of standards accompanying the test we may convert this score into educational age. We find that Jimmie's score is equal to that of the average child of ten years and four months. The question is: What is the probability of this obtained educational age varying from Jimmie's true educational age. Let us say that the achievement test has a probable error for true scores equivalent to about two months. Knowing this we are assured that Jimmie's obtained educational age has as good a chance of being less than two months below or above the true educational age as it has of being more than two months below or above the true age. Furthermore, since we know that the differences in scores on repeated tests approximate the normal curve, we can say that the chances are about 4 to 1 that his obtained educational age is within four months of his true educational age, and about 25 to 1 that Jimmie's obtained educational age is within six months of his true educational age.

Making Use of the Results of Tests.—Albert, who entered the first grade at six years, was very obviously not able to do the work the other children were doing. He was given the Stanford-Binet test, and the results indicated a mental age of about four years and four months, giving an I.Q. of about 70. This test and three others given by competent examiners during the next 3 years yielded I.Q.'s ranging between 68 and 72. Albert's performance in school subjects was in keeping with these results. Unfortunately, Albert was permitted to make futile attempts in the first grade in his sixth and seventh year. Not until his third attempt at first-grade work was he able to make any progress in learning to read, and before half the year

had passed the class was leaving him behind. It is a well-established fact that six years is a minimum mental level for learning to read. Albert was but adding one more bit of evidence to this generalization.

We use mental ages and intelligence quotients differently. We use the mental age to give us the present *level of development* of a child so that we may judge his general ability at a given time and provide the opportunity for experience appropriate to such a development. The intelligence quotient, by indicating the *rate of development*, tells us what we may expect with the passing of time. Albert at the beginning of his third attempt at first-grade work was on a par with the other children in mental age and for some months seemed to be holding his own with them. Time tells, however, in matters of development. The other children not only were learning faster than Albert but were developing faster; their ability to learn was increasing at a greater rate than his. Although Albert was not ready to learn to read, yet many worth-while experiences could have been provided for him, and his intelligence quotient offers the basis for predicting how long such a program might profitably be continued. In contrast to Albert's case, it might be predicted that Jimmie, with an intelligence quotient of 125, might be expected to take more responsibility than other children of his age in many activities that call for unusual mental ability, and the wise teacher would be watchful for opportunities to provide experiences in keeping with his ability and needs.

Relation between General Intelligence and Achievement.—What Jimmie and Albert and other children do with their respective abilities depends in part upon many factors that are not measured in an intelligence test. Children may be lazy, or they may be unusually energetic. They may be antagonistic in their relations to other children and to teachers, or they may be adaptable and willing to cooperate and make the most of their opportunities for participation in school life. Circumstances, such as a teacher

who is liked or one who is disliked, or interest or lack of interest in an enterprise that is under way, may make the difference between success and failure. Then, there are those broader reaches of attitudes and interests which determine whether a child is alive to new possibilities, constructive in making suggestions, agreeable as a companion, adaptable in times of stress, or subject to emotional disturbances—all or any of these characteristics may be a determining factor in the child's making good or poor use of the abilities that he might be expected to capitalize.

Granting that achievement in any performance or enterprise or school subject will vary with many factors that are not tested by an intelligence test, the fact remains that there is much agreement between the results of a good intelligence test and a good general-achievement test. Such agreement is commonly measured by the statistical procedure of *correlation*, a method that indicates mathematically how much agreement there may be between the pairs of scores that individuals of a group receive on two different tests.

Kelley,[1] after correcting correlation coefficients for their known reliability, concluded that the Stanford Achievement Test measured much the same abilities that the Stanford-Binet Scale was measuring. Nine-tenths of the abilities measured in the one seem to be measured in the other. This is not surprising when we note that many of the situations provided in these two tests are similar in nature and that success in either test depends upon the ability to learn. The achievement test purports to test what has been learned, but it thus gives a measure of the ability to learn. Many items in the individual intelligence test provide novel situations that test directly the child's ability to learn, but many other items are like those in the achievement test in that they measure the level of adaptations and learnings that have already been made. The Stanford Achievement Test, like many others of

[1] Kelley, *op. cit.*, pp. 193–196, 202–209.

similar nature, measures reading ability and the understanding of meaning of words of varying difficulty; it measures ability in arithmetic computations of varying complexity and problem solving requiring different levels of reasoning; it measures language usage, ability to spell, as well as information in history, literature, and science. Many of these types of situations are to be found in one way or another in the items of intelligence tests. Indeed, many of the group intelligence tests have been criticized because children must depend too greatly for success upon their ability to read. It still remains, however, that mental alertness, mental persistence, and the ability to organize experience into useful form are basic factors for success in both types of tests. The most useful purpose that intelligence tests can serve is to give us insight into these qualities that operate in the everyday experiences of boys and girls.

The Measurement of Special Abilities.—Some of the separate tests in any battery of achievement tests are found to correlate much lower than others with intelligence tests. Results of spelling, language usage, and arithmetic-computation tests do not correlate with mental age as highly as do results from reading tests, arithmetic-reasoning tests, and tests of general information. Language usage probably depends considerably upon the language to which a child has become accustomed; his score probably reflects the language of the home in which he has lived, and this may or may not accord with the ability of the child to learn. Spelling undoubtedly depends in part at least upon the ability to hear and distinguish shades of inflection which in many words and parts of words may be a clew to writing the word correctly. It appears that in some of these subjects we are getting away from the qualities that are the basis of what we call general intelligence, and we find that success or failure depends upon some special ability or upon circumstances of life such as living in a home where the right language forms are used.

When the results of general intelligence tests or of achievement tests are compared with the results of tests in music, or handwriting, or quickness of muscular reaction to stimuli, or coordination of muscles and physical dexterity, we find we are in realms of behavior still farther removed from general abilities than is ability in language usage, spelling, and arithmetic computation. In the low correlations found between mental age and ability in these fields is found the justification for designating some abilities as special in contrast with others which enter more universally into human behavior and learning. We have, for example, the dependence of performance in singing upon the nature of the voice mechanism. Every voice can be trained, but it is very apparent even to the casual observer that nature sets the limits of development in the inherited structure of vocal organs. Even more striking is the fact that the auditory abilities that are essential in musical performance are independent of the more general factors in human behavior. Scores on the Seashore tests of musical ability[1] show a very low correlation with general intelligence, and they have a low correlation with tests of knowledge of the notational system in music. Prediction of success in sight singing may be made with much greater assurance from the Seashore tests of pitch and tonal memory than it can from extensive tests of knowledge about the notational system.[2]

Organized play in football, basketball, and other sports is a challenge to intellectual ability, but the specific skills and the matters of strength and dexterity have little relation to intelligence. Handwriting shows a similar low correlation with intelligence. Particular appearances, shapes of heads and other physical factors do not appear con-

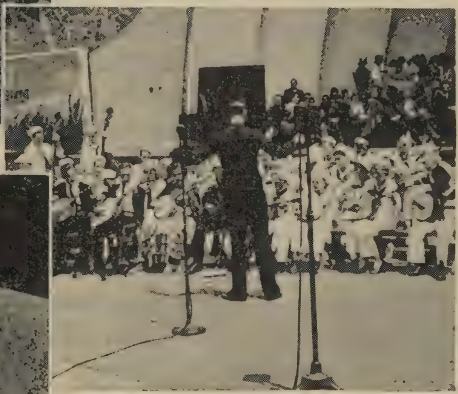
[1] Seashore, C. E., *The Psychology of Musical Talent*, Silver, Burdett & Company, 1919.

[2] Salisbury, Frank S., and Harold B. Smith, "Prognosis of Sight Singing Ability of Normal School Students," *Journal of Applied Psychology*, Vol. 13, pp. 425–439, 1929.

(*Courtesy of Los Angeles Public Schools.*)

(*Courtesy of Los Angeles Public Schools.*)

(*Courtesy of Los Angeles Public Schools.*)



(*Courtesy of Los Angeles Public Schools.*)

(*Courtesy of Pasadena Public Schools.*)

A Few of the Activities in Which Special Abilities Play a Prominent Role.

sistently with any of the levels of intelligence. To be sure, intelligence is used to capitalize life situations that involve physical characteristics and special abilities, but the fact remains that intelligence and many special traits may be found in widely varying degrees in the same individual. This fact is the basis for labeling some of these as special, in contrast to others that we label general.

Desirable Traits Are Positively Correlated.—Lack of high positive correlation between general and special abilities should not be mistaken for negative correlation. Special, in the sense here used, is a matter of degree. On the whole, desirable traits are found to be positively correlated. In other words, if an individual is above the average in one desirable trait, the chances are that he will be above the average in other desirable traits. Nature is not compensatory; it does not assure that in an individual a low degree of one trait will be balanced with a high degree of another. To be sure, an individual varies in many respects; he is born with greater capacity in some lines than in others, and develops in some lines more than others. But when his abilities are all compared with those of many other individuals, it is seen that there is no basis for a theory of compensation.

Kinds of Intelligence.—For many years, there has been a difference of opinion concerning the organization of the more general abilities in human nature and their relation to special abilities. These interpretations are based upon statistical analysis of extensive test data. One school of thought, with which we associate the name of Spearman[1] as a leader, has contended that there is a single central factor, *general energy*, which runs through all kinds of activities of an individual. Along with this general factor, there are various special factors that are peculiar to certain fields of experience, such, for example, as music.

[1] Spearman, C., *The Nature of Intelligence and the Principles of Cognition*, The Macmillan Company, 1923.

The other school of thought, led by Thorndike,[1] has contended that intelligence is shown to exercise direction in behavior in three general fields, which overlap to a considerable extent, but which are distinctive to an extent to warrant their being treated separately. These three fields are: (1) the field of experiences that deal with *abstract thought;* (2) the field of experiences that center in *physical performance;* (3) the field of experiences that are concerned with *social relations.*

More recently, the work of Spearman[2] and his students has recognized other factors which are supplementary to a central general factor but which do not affect all the experience of an individual in the same universal manner as does the general factor. These are correlative to the general factor and not special factors. One of these correlative factors may be thought of as *facility* or *quickness* or *originality;* looked at in reverse, it is seen as *mental inertia* or *lag.* Another correlative factor of which Spearman writes is *oscillation of mental efficiency*, which is probably related to fatigue. A third correlative factor is the *tendency to retain dispositions*, which varies greatly and may be quite superior in one kind of mental operation and not superior in another. A fourth correlative factor is given the term *self-control* or *purposive consistency* and manifests itself by causing the behavior of one person to appear as having more "common sense" than that of another individual.

Thus, Spearman presents us with a scheme for understanding human nature, a framework through which we may interpret the wide range of behavior that we meet in the lives of different individuals. To give point and meaning to Spearman's interpretations, the reader may wish to give himself an evaluation with the use of this scheme, using

[1] Thorndike, E. L., *Educational Psychology*, Teachers College, Columbia University, 1910.

[2] Spearman, C., *The Abilities of Man*, pp. 409 *ff.* The Macmillan Company, 1927.

the customary A, B, C, D, E grades for each of the factors. First, compared with other individuals, what value will you place upon the general-energy factor that operates in all your activities, which you may think of as your general intelligence? Then, of lesser significance, what values will you give your mental quickness and originality; or, conversely, to what degree are your mental processes characterized by inertia? To what degree do your mental processes vary, and how susceptible are they to fluctuation due to fatigue? Then, for the tendency to change or persist in mental sets or dispositions, you may expect to give different values for each of several general fields of experience. The value you give to your common-sense factor should be concerned not with how well you can think, abstractly, but rather with how reasonable and practical and balanced your thinking and actions are. Having thus appraised your mental ability in terms of the dominant general-energy factor and the correlate factors of quickness, fluctuations, persistency of dispositions, and common sense, you will wish to indicate some of the special fields in which you think you have marked ability. Much work remains to be done in locating these special fields, which appear so definitely independent of the general factor and of each other. Music is undoubtedly one of these. For further guidance in the location of such special factors, we can only look for particular sensory and motor abilities that seem to be unusual in their function.

The work of Kelley[1] leads to conclusions that seem less abstract and removed from life than those of Spearman. Much the same procedure and much the same type of test data underlie the conclusions of the two workers, but the terms and definitions used by Kelley appear to arise directly from the data as the basis for a particular conclusion. Naturally, such a scheme of interpreting individual differences is more directly useful to the teacher. Kelley's studies are in agreement with those of Thorndike to the

[1] Kelley, *op. cit.*

extent that Kelley concludes that we are justified in dealing with several kinds of intelligence, among which are three types similar to those named by Thorndike. Comparable with Thorndike's *abstract intelligence* is Kelley's *verbal intelligence*, and there is much the same meaning in the terms *social intelligence* and *activity* (*mechanical intelligence*), as they are used by these two workers. Kelley, however, finds sufficient evidence to treat separately *quantitative intelligence*, which underlies facility in the use of numbers, and *spatial intelligence*, which functions in dealing with geometrical forms. The tests that measure *quantitative* and *spatial intelligence* are commonly found as parts of tests of general intelligence. Kelley not only treats these independently but further breaks up the commonly accepted notion of general intelligence by treating *memory with reference to verbal material* as a separate function.

In addition to the above noted intelligences and the memory for verbal material, Kelley would have teachers know more of the interests of children that parallel verbal, social, and activity intelligence, for which he recommends the use of questionnaires and such tests as those of Wyman and of Cowdery which were discussed in Chapter XI. He would likewise have at hand data that would help in making us aware of the differences in children's special interests and abilities that are related to particular sensory or motor capacities. Kelley finds evidence which prompts the suggestion that the factor of speed may possibly be included in this survey of significant aspects of individual differences.

Thus, we find studies leading to conclusions that warrant our thinking of human nature as being dominated by several central factors, including ability to use language, ability to use numbers and quantitative concepts, comprehension of space relations or geometric factors, ability in the field of social relations, and ability in the field of activities and of the mechanical. The varying values and interrelations of these factors naturally result in individuals of

widely varying ability and attainment. To the variations of these more general abilities, there must be added those that arise from special abilities. It is in the flux of this complex pattern that we must search for a basis for interpreting individual lives. As the child develops into youth and the youth develops into maturity, the patterns change; to the development of natural abilities are added the fruits of experience. Within the limits of inherited capacity lie wide ranges of opportunity to create worth-while lives. The civilized world in which we live has developed in the same highly differentiated fashion as have human beings, and we therefore find it possible for the special abilities of individuals to be capitalized in successful and worthy pursuits.

Summary: Common Sense with Scientific Tools.—This chapter has been concerned with a brief discussion of some of the statistical methods and measuring instruments most commonly used in interpreting individual differences. This approach to the study of human nature is one in which objective data in the nature of raw scores of tests and of other measurements are obtained for numbers of individuals instead of a few. The probable errors decrease with the number of subjects, there being a probability of the error in one case being offset by one in the opposite direction in another case. Premium is placed upon tests that are reliable, giving results on one test that are consistent with other forms of the same test. Premium is placed upon tests that are valid, giving objective data that are truly representative of the ability the tests are intended to measure.

Sufficient consideration has been given to the relations of measures of various kinds to make it apparent that no small degree of insight is required for the interpretation and application of results of tests to individual cases. Undoubtedly, this field of applied psychology has done much to raise the control and direction of school organization and procedure to a higher plane; yet enthusiasm for a new instrument has many times resulted in our missing

our main objective of knowing more about some child about whom we know too little. These instruments can and do, when intelligently used, reveal much that is hidden to the eye of even the best teachers and parents. When they do not reveal everything that is to be desired, it is possible for them to provide a new and better base of operations from which more investigation, either with measurement or with the ever-present instrument of common sense, may proceed to further understanding.

The history of this movement has been one of increased complexity of statistical method, of broader fields of instrument construction, and of more refined interpretation; at the same time, it has been a history of closer and closer companionship and better understanding between teachers and parents and children. Here we have one of the "handmaidens" of a profession, giving us quickly information concerning groups and individuals, telling us the reliability of the measures we have, suggesting to us the implications that the results may hold for practical understanding of learners of every age. This field is one worthy of separate study; it is treated here because it belongs in the pattern that our study covers. The teaching profession has passed through the period of using the new tool like a boy with a new hatchet; let the beginner of today realize this and set for himself the practical common-sense goal of learning how to make this tool operate for increased understanding of children who are so often in need of understanding.

In the chapters that follow, we shall continue our study of individuals, first considering the development of emotional control that grows out of social experience, then the way in which our lives develop into the complex unified wholes that we call personalities, and later the way in which special abilities develop into various esthetic experiences. In all these, we are searching for understanding of how human beings may capitalize the inborn capacities in the creation of distinctive personalities.

SUGGESTIONS FOR NOTEBOOK AND BULLETIN BOARD

1. Collect from newspapers and magazines examples of graphical representations of distributions to show the varied use made of statistical method in everyday living.
2. Collect news items and organize illustrative material which show the variety of special abilities that may be capitalized to make successful lives.
3. Parallel the display resulting from the suggestion in item 2, with news items and illustrations to show the variety of human endeavor that seems to depend largely upon general intelligence.

DIARY OF YOUR OBSERVATIONS

1. The suggestions in items 2 and 3 above may be worked out on the basis of a survey of the businesses, professions, trades, and occupations of people in the area in which you live.
2. Observe the development of some enterprise in a schoolroom, playground, or home in which children have worked out an organization that shows recognition of the varying abilities of different members of the group. The same sort of study may be made of some social group of which you are a member.
3. Make a list of abilities of various kinds that you consider of possible significance to success in life. Judge your own capacity in these, checking your estimates on an A, B, C, D, and E scale. Do you account for the points in which you rate highest as being due to inheritance or to circumstances that are responsible for a highly developed interest? How do you account for the points in which you rate lowest? Do some of the low ratings represent phases of your life in which more than an average degree of native ability has remained undeveloped? If so, how do you account for the lack of development?

SUGGESTED READING

1. Note in the manual of some standardized test the specific nature of the instructions for giving and scoring the test and for the interpretation of the resulting scores. Note the provision for interpreting the raw scores. The equivalents of raw

scores, based on the testing of large numbers of children, are generally given in age equivalents and in grade equivalents; by such interpretation, the resulting age and grade scores of different tests are made comparable.

2. In Brigham, C. C., *A Study of American Intelligence* (Princeton University Press, 1923), the reader will find interesting data showing variations in the attainment of army recruits on the Army Alpha Intelligence Test. These data show comparisons of averages of different economic, vocational, and racial groups. It should be noted that the differences in averages of such groups are much less than the differences within any one of these groups; this fact does not lessen the significance of the group variations.
3. For a general statement of the significance of individual differences, the reader is referred to Thorndike, E. L., *Individuality* (Houghton Mifflin Company, 1911). Note particularly the introduction and the last chapter.
4. In Chap. 5 of Kelley, T. L., *Interpretation of Educational Measurements* (World Book Company, 1927), the reader will find an excellent survey of the studies concerned with the issue of whether we are to think of intelligence as a single general factor or as operating in several distinct fields of experience.

Chapter Fifteen

Emotional Control and Social Behavior

In Chap. VI the discussion led to a realization that emotional behavior is very closely related to the necessities of self-preservation. Emotional patterns of behavior are often anything but intelligent, yet we look to intelligence as a means of emotional control. Many are the incidents of everyday life in which emotional stresses are brought under control, and many too are the occasions when they run their course in destructive emotional behavior or are left with the issues compromised to make life unhappy and at times lead to mental unbalance. In this chapter, some of the affairs of everyday life will be examined in a search for better understanding of the practical problem of emotional control.

The Psychic Catharsis of Laughter.—Many a situation that might otherwise lead to fight or flight is saved by the emotional house cleaning of good laughter. The saving grace of humor lets one sense, even though one may not fully understand, the presence of inconsistencies that are at the root of the stress. This sensing of inconsistencies is highly intelligent, and since it is exercised under stress, it should be accorded high value. A sense of humor is most wholesome, wholesome in the truest meaning of the term, because it leads to bringing into a whole the conflicting elements of emotional patterns and those of a rational nature.

Note the interplay of the emotional and rational in the three mother-son relations that are described below. For our purposes, let it be supposed that three boys, each about eight years old, came home from school, wet and covered with snow. Each had been particularly instructed by his mother, "Do not play in the snow because you have a cold." In each case, let us suppose that the mother met the sight of her snow-covered son with the exclamation, "Why, Son, look at you! What have you been doing?" In each case, the son replied, "I fell down." What happened next varied in each case, because these outwardly similar circumstances had their setting in different past relations of respective sons and mothers. The situation offered ample opportunity for intelligent control of emotional behavior. Let us take each in turn and note what happened.

One of the mothers drew herself up with flashing eyes and sized up the situation as follows: "You have not only been disobedient, but you are lying to your mother. You could not have fallen and got so much snow on you. You must be punished."

The second mother told her son, "I am all broken up to think that you did not mind me. Then to think that you would come home and lie about it!" And she reasoned, and reasoned, and reasoned, still doing nothing about the situation. "You might die of pneumonia," she said. "Just look at your clothes, and they were pressed so nicely when you left for school. Don't you love your mother? What will your father say when he gets home? Why *do* you do such things?" It should be noted that this son was in the habit of repeatedly doing just such things.

The third mother was disturbed as were the other mothers. She had learned, however, to expect unusual things from her red-blooded son. She turned him around to take a good look at him. When he said, "I fell down," she asked, "Where did you light?" The son grinned and answered, "All over." They both laughed, but his laugh

started a cough, and the mother promptly did something about it and the whole situation. Actions followed words quickly. "We'll get you into a hot bath, and then into a warm bed, and you will stay there till dinner time." Later, with bath taken and bedclothes tucked in, she gave him a half-friendly, half-provoked spank but said nothing about punishment. The son thought as she left him, "If you get yourself into trouble, Mom sees that you get yourself out."

Emotional and Intelligent Factors in Social Relations.— The cases cited above are typical of the interplay of intelligent adjustment and the emotional dynamics found in human behavior. Adequate description of the experience of any one of the sons would require a portrayal of the situation and a description of the actions and mental state of his mother. Behavior on the part of one person leads to behavior on the part of another, the nature of the latter depending upon the character of the former. The variety of such behavior and the variety of interrelation between intelligent and emotional factors in different individuals are infinite.

Our language is taxed to find terms that will convey the meaning of such varied experience. Note the terms in the following, in which each expression indicates in a general way the mental state of an individual, and each seems to imply another individual who in some way is responding with another mental state. If one is angry, the other may also be angry, or afraid, or fearful, or disconcerted. If one is enraged, the other may respond in rage or may take to flight; in the latter case, the first person may be overbearing, insolent, imperious, bullying, or domineering. Whichever term best fits the facts, one's thoughts go out to the other party or parties of the social situation, wondering what response may be aroused. There are the timid and fearful, the yielding and conforming, the obedient and acquiescing, the disconcerted and embarrassed individuals, who come into contact with the more positive and over-

powering activities of opposite types. Or it may be that the response is of the detour character, one that neither meets the aggression with counteraggression nor turns in negative action and gives way to it. Such individuals cannot stomach conflict, and yet they are not timid; they find peace in evasion, in counterfeit adjustments, in duplicity, in pretense of one kind of response when they are really under the influence of a quite different emotional state. There is the third type of adjustment, which is in its very nature satisfactory to all parties concerned in the social experience; mirth and good feeling or the friendly rivalry of wit and humor give character to the experience and result in a balance between the emotional and intelligent factors of the behavior of the different individuals involved. Perhaps the occasion is like that of the third mother and son, who made a good adjustment out of a trying situation, with the impulse to emotional responses turned into constructive and cooperative accord, challenging the saving sense of humor and sympathy and understanding, rather than giving way to the impulse of unbalanced aggression and begetting an equally unbalanced response of fearful regret or an unsatisfactory two-faced evasion.

The variety of experience in the lives of any one of us is so marked that we can guess the complexities in the lives of others. Seeking for some practical avenue through which to organize our thinking in this field of emotional experience, there seems to be no approach that is more useful than that of interpreting our varied experiences as an interplay between the intelligent and the emotional factors in our behavior. Such an approach has the advantage of being well grounded in the results of investigation and experimentation which have revealed the nature of intelligent control and of emotional organization.

Interpreting Cases of Emotional-intelligent Behavior.— Let us turn again to the three mother-son situations and note the applicability of this interpretation of adjustments. The behavior of the first mother is plainly emotional,

and there is evidence of too little intelligent adaptation. She is aggressively domineering and arbitrary. The behavior of the son is equally emotional and lacking in intelligent adjustment since it is dominated by fear and timidity. In both individuals, the thalamic-visceral systems are in control, the general character being positive and aggressive in the case of the mother and negative and fearful in the case of the son; in neither does intelligent adaptation have much chance. Neighbors say that the mother "doesn't use a bit of sense in handling the boy." The boys of the neighborhood say the son is a "sissy."

In the second mother-son situation, the behavior of the son is a good example of evasion and duplicity in which a counterfeit adjustment to the situation is made. This boy would dominate the situation if he could and feels strongly the impulse to tell his mother to "shut up." But he is smart enough to know that this would only lead to more talk, and possibly punishment. So he says, "Yes, yes, I understand, *I understand*." As he explained one day to a boy companion, "All you can do is just let her run down." He is a full-blooded youngster, and his vital thalamic-visceral organization protests against subservience; but his intelligent cortical organization has learned through experience that it is easier to go with the tide. There was a time when he did not know this, when the primitive patterns were dominant and took the form of temper tantrums—a wonderfully expressive term for highly dynamic, uncontrolled, thalamic-visceral behavior. Children soon learn whether or not such behavior is successful. Older and wiser now, the boy has learned the trick of complying, but tomorrow will find him in the snow again.

Strange to say, the persistent reasoning of the mother in the second incident, instead of being a deterrent, is a stimulus to the boy's getting into trouble again. Though she can get the best of the situation when she is with her son, his continued resentment impels him to show himself that he can "be his own boss" when she is absent. Thus

there comes about a vicious circle: first, he gets into trouble; then she talks and talks and stimulates his getting into more trouble; more talk, more trouble; more trouble, more talk. The adjustment of this son is intelligent, but not intelligent enough; it is a compromise that does not settle the basic emotional issues because it does not settle a basic social relationship or develop a suitable guide to future experience.

The third mother-son situation represents cooperative adjustment in which both parties bring their dynamic vital organizations into an intelligent, reasonable alliance. Neighbors say that the mother is wholesome. The boy is known to his companions as "a square shooter" and a "good egg." Cooperative understanding through intelligent control characterizes the adjustments of both mother and son in the situation described. The behavior of both is intelligent, and yet it is human, too, and emotionally responsive. The emotional and the intelligent are brought into a working alliance. A survey of the thought processes of the mother would find a swift-flowing pattern with something like the following in it: "Heavens! Boys will be boys. Will he ever grow up? Of course he will. Some day he will have better judgment. That cough sounds as though his cold were loosening. Must get those wet clothes off. Hot bath. Warm bed. Rest." The dynamics impelling to emotional behavior are thus given an outlet in intelligently directed constructive action. The boy also played a similar part in this cooperative game. Realizing that he had done something he should not, he had run home from the scene of the piling in the snow, slapping the snow from his clothes as he ran. He knew about what his mother would do, and he knew about what he would do when he reached home, but the stage was set for almost anything to happen. The actual development turned on the saving grace of humor; he joked with his mother when she joked him about his "fib" of falling into the snow. He said to himself, "No use trying to fool her, she knows me too well. Gosh! it's

good to have a mother like mine." Thus into the bath, then into the warm bed—and he understood that little spank his mother gave him before she left. He understood that there was an element of admonition in it, but he knew, too, that there was something else in it. It was from one player in the game of life to another; it said, "The game is still on and we will win yet, or at least play the best game in us." It also said, "Don't muff the ball like that again." As a result, the boy is on his way to doing a better job in the future, to using better judgment. "Guess I better use my head," he said to himself after his mother left. "Better put on different clothes to play in the snow. Better stay out of the snow when I have a cold—but gosh! it was fun!"

Cooperation under such circumstances means that all parties concerned are required to use intelligence, and that each must recognize the vital emotional interests of the other fellow. The mother was disconcerted; but she "counted ten" as she turned the boy around, and in less than "ten" the first impulse to uncontrolled emotional action was lined up with reason and a constructive handling of the situation. The resulting behavior is spoken of as good common sense, a most suggestive phrase—*common* referring to basic old-brain organization, *sense* referring to intelligence of the new-brain organization, *good* being the proper term to indicate the wholesome way in which the two are brought into a cooperative alliance.

Adjustment between Inner and Outer Demands.—Looked at in one way, the interplay of intelligent and emotional factors in behavior represents the balancing of relations of the inner and outer circumstances of life. On the one hand, there are the impelling demands to adjust to outer circumstances, requiring intelligent adjustment; on the other hand there are the demands of the inner dynamic forces, essential to continued life and self-preservation, which are the basis of emotional behavior. There are behaviors in which the needs of the inner vital forces

dominate the pattern of behavior with little apparent regard to an intelligent interpretation of the outer circumstances. "Rule or ruin" seems at times to be the basis on which such behavior is ordered. Under the dominant control of the emotional, there literally are brain storms as far as cerebral control is concerned, the individual giving way to unreasoned rage, passion, or fear. At times, the beginning of such behavior arises from some overwhelming situation for which the individual is unprepared or to which he is incapable of making an intelligent adjustment.

It is apparent that better adjustments are made when there is a union of the emotional and the intelligent. The degree to which cooperation between these can be effected depends of course upon both the inner and outer circumstances. Many a situation that could be easily adjusted through intelligent action is hampered by the continuance of an emotional disposition that may have been aroused by circumstances quite unrelated to the situation at hand. Thus, the businessman may bring his "grouch" to a family that awaits him with affection and consideration. At other times, emotional stress has its origin in the interruption of intelligent and rational activity. Who does not resent, under most circumstances at least, having his work or reading interrupted? Actually, there is conflict in such a circumstance between the dynamics of two emotional trends, for the intellectual pursuit has its setting in interests and desires of the individual that may not show on the surface of the observed activity.

The most desirable type of experience is to be found when the inner vital forces are brought into cooperative accord with the outer circumstances of life, and at the same time the outer circumstances of life are molded intelligently so as to yield the greatest possible amount of inner satisfaction. Such behavior is fashioned under the guidance of an intelligent principle that appeals to both new-brain and old-brain organizations, namely, *to make the most of*

life. Under such a banner, both the inner vital forces that are essential to existence and the intelligent interpretation of the issues raised by the changing outer circumstances are brought into cooperative accord. Emotional patterns of rage and conflict close the doors to intelligent adaptation. Unreasoned submission to fear of outer circumstances signifies a surrender of the intelligent capacities when they are most needed. Evasion and duplicity are more intelligent than abject submission; however, not only may such compromising of basic nature with circumstances leave issues unsolved, but also it may leave one disorganized and less capable of meeting new issues. By cooperation of the basic and the intelligent, present problems are solved and we organize experience into concepts, generalizations, attitudes, and expanded interests so that we are more capable of meeting the issues of the future.

Beginnings in the Development of Emotional Control.—What people do in particular situations depends both upon the outer and upon the inner circumstances. This is true at all stages of development. In the early weeks after birth, the development of the infant is a matter chiefly of the organizing of the vital patterns under old-brain and autonomic centers of control. Higher brain areas are just beginning to function, and the organism has very limited ability to use these centers in adapting to outer circumstances. This fact, however, should not lead to the conclusion that the adaptations of the early months after birth are not to some degree intelligent, for the capacities for intelligent adaptation have an early beginning. The inherited patterns of behavior of the human infant adapt to the outer circumstances as they mature, and good mother care and training and other experience have their influence in modifying them. Since these patterns are the very ones that continue throughout life as centers of emotional behavior, it is important during this period of early maturation that training be coordinated with natural development to ensure an emotionally well-balanced character.

The problem of emotional control has its beginnings before birth. For example, the inherited unbalance of certain endocrines may cause cretinism which affects both intelligent and emotional development. Some inherited weakness of the nervous system may load the dice in the direction of instability, or some physical deformity may lead to serious limitations resulting in problems of emotional adjustment. Even the commonplace differences in good looks may determine the social relations in infancy, childhood, and youth in a way that leads to emotional stresses which may cause permanent maladjustments. These are facts to be faced, for something can be done about cretinism and about deformities, and even about good looks, and certainly something can be done about the social relations that make differences in the ultimate issues in many of these cases. Many a fine character has developed in spite of handicaps. The question is: Given the child as he is at birth, what practical insight can be had as a guide for assisting in sound emotional development?

Emotional Control in the First Year of Life.—In Chap. VI, there is outlined the general features of developing emotional life of the child during the first year of life. Basic physiological adjustments determine the character of life during the first weeks, and the first few months continue to be devoted to getting the basic vital patterns in good running order. Not until the fifth month are there sharp rises in the development of patterns that reach outward to the environment. In the early days, the child reaches for food near at hand through patterns that are fairly well formed at birth. He cries and protests unintelligently when he is cold, or uncomfortable, or when some noise disturbs him. The child first reaches for food crudely, and in the very reaching the pattern changes. He is apt to give forth a squall if he does not get food when he is hungry, but soon the squall is a distinctive cry, so that the mother recognizes the nature of the need. At first, he is difficult to please in his food; it must be just right in temperature, and he

protests if it varies in taste. Later, he learns to like many kinds of food. This early experience of food getting seems a lowly beginning for emotional control; but here is a basic pattern of behavior, and here in the relations with the mother are the roots of social experience from which arise emotional control. Mothers differ in child care at this stage

(*Courtesy of Los Angeles Public Schools.*)
Education in the Care of Infants Is Receiving Attention in Many Schools; Sound Social Relations Are Based on Knowledge and Understanding.

just as they differ in the way they adjust to their sons falling into the snow, and the consequences of these social relations are fully as significant as those of a later period.

In the first weeks of a child's life, there are concerns other than food getting; for a baby must be kept warm, but not too warm, and he must have rest and sleep. It is generally granted that good child care calls for systematizing the routines of food taking, sleep, and the processes of elimination. Does the development of emotional control have its beginnings in such prosaic matters as nursing

bottles? Just so. Emotional behavior is basically related to the thalamic-visceral patterns that control the essentials of life. Furthermore, not only in infancy but throughout life the supplying of essential needs leads the individual directly into human relations in which emotional balance and control are factors in success or failure. A common-sense view of the matter dictates that a happy life can come to a babe only through intelligent care in these matters that are close to his essential needs. Good care leads to good health, good health leads to contented existence, contented existence leads to well-balanced patterns of the basic thalamic-visceral order, and these are nothing more or less than well-balanced emotional patterns.

One needs but to reflect upon the vicious circle that continuously appears, involving emotional unbalance and disorderly function in essential behaviors, to become convinced of the importance of good basic habits. For example, bed-wetting may be a failing that continues into the sixth or seventh year of a child's life; the cause of such a condition can generally be traced to maladjustment in relations with those close to him. The whole range of control from endocrines up becomes involved in the patterns of behavior that control elimination of waste products. Lack of attention on the part of the parents may lead to discomfort and nervousness and irritability in the infant, and thus to an irritated parent and rough handling, which beget emotional responses to which disturbed parents respond in turn by scolding and spanking. Normally, a child can be trained in habits of elimination in the same general way that he is trained in habits of food. The issue lies in the care with which the parent works with the developing capacities for control. The force of the argument lies in the fact that these essential bodily processes are the center of life in infancy, and they are at the same time the basis for the developing social relations between mother and child. One can easily picture the wide differences in these early social relations, such, for example, as would

undoubtedly be found in the three mother-son cases previously discussed. One need not look elsewhere for the beginnings of the dominance, submission, or other characteristic emotional responses that persist and become fixed in the lives of children.

Affection and Emotional Development.—Human beings are by nature affectionate. Babes are born with well-developed behavior patterns of clinging and cuddling for protection and warmth, and parents commonly see in such patterns the natural tendencies to affection. It would be difficult to trace the roots of such behavior, but the dependency of the human infant warrants our considering the need of protection and the need of satisfying the demands of hunger and warmth as part of the patterns that in all probability contain at least the beginnings of the affectionate aspects of human nature. The developing character of the babe during the first year shows a marked increase in the positive type of responses and a lessening of the negative, protesting type. He smiles more, does more cooing, and otherwise shows marked increase in his expression of that which we term affection. If the social relations warrant it, these early beginnings continue as a natural development of behavior. A wide range of social relations has this element of affection in it, beginning with the natural dependency upon the mother, widening to include the remainder of the family circle, thence to neighbors and friends, and at maturity to the love between man and woman that culminates in marriage.

Affectionate behavior in all its variations is essentially social in nature. Affection must be reciprocated, or it dies. Nature has set the reciprocal patterns in both mother and babe; it is as natural for the mother to protect and feed and give affectionate and sympathetic care as it is for the babe to need these and seek them. The relations of the mother to the child are naturally closer than those of the male parent to his young, but observation provides us with ample evidence of the concern of both parents for

their offspring. It is so in other species than man. Male birds share in tasks of sitting on eggs and providing for the young. The males of herd animals are adapted by nature for protecting the weaker members of the herd; other species have a single mating which binds the parents into a union centering in the care of the young. The survival of the species is dependent upon these basic patterns, and the longer the period of infancy the stronger are the ties holding the members of the family in a type of personal relation that is at the base of the affectionate aspects of behavior. The infant of mankind has a long period in which to come to full development, and it is to be expected that the affectionate aspect of his life experience should be one of the dominant factors in his behavior.

Weaning: Physiological and Psychological.—The babe needs affection for normal development, just as he needs food and warmth and protection; but just as wrong food habits may lead to indigestion and wrong social relations in food getting may lead to unwholesome emotional habits, so also may the normal development of affection be perverted. The evidence from clinical cases of later childhood and youth and of mature years indicates that persistent maladjustments often have their origin in the early social relations of child and parents. The difficulty may often be diagnosed as a failure in normal psychological weaning.

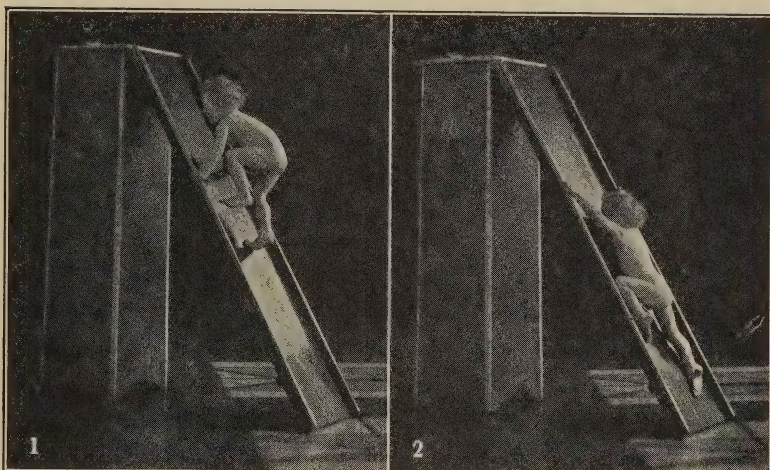
Perhaps no better practical guide to right parent-child relations may be had than the perspective that is implied in this idea of gaining social independence. Weaning in matters of food getting is natural to both mother and child. Physiological changes take place in the mother that tend to bring the nursing period to an end as nature looks forward to the birth of other offspring, and at the same time the demand of the growing child for more food tends to exceed the natural supply. Nature's provisions for meeting this demand are seen in the child putting everything into his mouth, cutting teeth, chewing on things for the fun of it, developing a taste for various kinds of food,

and marshaling the digestive tract for new orders of responsibility and independence. Paralleling this physiological weaning there should go a psychological development in keeping with it. From a social relation of dependence in which the parent is the dominant character, there should be a transition to one in which the child's individuality and personality warrant a relation that is essentially cooperative. The trend is always to more and more independence on the part of the child, and, for that matter, on the part of the mother as she is released from the care of the infant.

In short, it is natural that children should be weaned; it is natural and desirable that children should gain self-reliance psychologically as well as physiologically. As the infant develops into the child, and then into the youth, he grows more and more independent, gets further and further away from the intimate contacts of affection and protection. These basic needs remain basic throughout life, but they find expression through more and more diverse channels until the time when the mature individuals set up their own establishment for the protection of another generation.

Working with the Grain.—The need is for parents to work intelligently with the natural processes of growth and maturation. Nature's emotional organization spurns domination; it resents being submissive, but it yields to timely inducement. Review the work of Gesell and his coworkers (see Chap. X, pages 276 *ff.*), who taught one of the identical twins to climb stairs, handle blocks, and talk, while with the other twin they let nature take her course. Training in stair climbing gave an advantage to one twin, but this was soon overcome by the natural maturation of the other. Little or nothing of permanent advantage came from the training in handling blocks, and there seemed reason to believe that the training in speech at this period was a hindrance. These experiments are not concerned with patterns that can be considered particularly emotional

in nature, but they are in accord with the principle that it is best to work "with the grain." More recent experimentation with twins by McGraw[1] is more pointedly concerned with emotional development. During the first twenty-two months of life, one twin was encouraged to make a fearless attack in all naturally developing activities. For example, when he learned to creep, he was encouraged to creep up



Training Led to This Spirited Attack by a Child under Two Years of Age; 1, Going Up a Steep Incline; 2, Coming Down. (*From M. B. McGraw, Growth,* D. *Appleton-Century Company,* 1935.)

inclines; he was encouraged to feel safe in high places and would jump from pedestals 5 or 6 feet high into the nurse's arms. He learned to roller-skate at the time that he learned to walk. He outstripped the other twin and other normal children in what he was able to do, but even more significantly he developed a general attitude of fearlessness and initiative that was unusual. Two and one-half months of training in these activities, however, given to the second twin at the end of the twenty-two months, greatly reduced the advantage, gained through longer training, of the

[1] McGraw, Myrtle, "Summary of Early Report," *Psychological Bulletin,* Vol. 31, pp. 748–749, 1934.

first twin. Furthermore, at the end of twenty-four and one-half months both children were given identical training in new activities, and there was no evidence that the first twin had any distinct advantage because of his more extensive training.

Further experimentation by McGraw on these and other twins[1] demonstrates the differences in emotional development that are possible through training, but they indicate also that nature has its own plan of growth and development. It should not be concluded from such experimentation that there is no place for good training. Such experiments are certainly suggestive of what might be done through consistent, long-time guidance by parents. Too often this responsibility is passed by with the remark, "He is so much like his mother," or "She is the image of her father." The significant fact that should dominate the attitude of parents is that each child is an individual and as such is unique and that through the social relations in which he lives he is developing a unique personality. Respect for this developing personality is the key to right attitudes on the part of parents. Out of such respect may well come the cooperative social relations that are the normal setting for intelligently induced patterns of emotional control.

Children Take Over Their Problem of Developing Control.—An encouragement to parents who attempt such a constructive program is found in the growing capacity of the child to objectify his own problems of emotional control. Very early in life he becomes an active participant in these adjustments, cooperating when the nature of the experience is conducive to cooperation. It is the character of the social relations that determines whether he cooperates, complies, submits, or rebels. Recall, for example, the third mother-son situation in which the sense of humor provided the cue to action and adjustment. Here are evidenced permanent attitudes on the part of the boy to play his part of the game. He is forward-looking in the

[1] Hansl, Eva B., "Incredible Twins," *Parents Magazine*, pp. 34 *ff.*, May, 1935.

development of permanent adjustments that will direct his behavior more successfully in the future. Another interesting case, chosen from many on record, is that of Sarah,[1] the older of several children in a Japanese-American family. As a young child she was "extremely willful and quick tempered. She would throw herself on the floor and scream with rage." On such occasions she was "put in a room by herself, or in a closet (with the door open)." Before she was two years old, she had "learned to go into the closet by herself when she felt the need of it." With these and other cases as examples and with our understanding of the normal capacity for cooperation between intelligent and basic emotional patterns of behavior, the conclusion is warranted that the early years of life are highly important in developing emotional control.

Emotional Adjustments of Adolescence.—The problems of emotional adjustment during the adolescent period are, as are those of every level of maturity, a matter of coordination of the dynamic emotional organizations and the higher rational centers. Both organizations undergo marked and rapid development during this period. Naturally, the changes that take place in the thalamic-visceral organization and the whole body structure result in great stimulation and energizing of the cerebrum. The inner changes lead to a complete reorganization of social life, and the intelligence of the individual is challenged because of the new relations with the outside world that must be worked out. The people with whom the adolescent boy has established relatively stable relations through a period of years now find him a new person. Parents and friends naturally act differently in the situations that arise in living with changing youth, and youth in turn reorganizes his notions of this outer world of people. His relation to the world of things changes as he changes. The physical body will not fit into old clothes; the chairs that once

[1] Terman, L. M., and others, *Genetic Studies of Genius*, Vol. 3, pp. 293 *ff.*, Stanford University Press, 1930.

held him now tend to break under his added weight and awkwardness. The whole of material and social relations and of the outlook on life changes. These adjustments lead to a reorganization of concepts and interests and result in a temporarily disorganized mental pattern, forced to action from within and acted upon by a world of changing relations from without.

The changes in the inner life of the adolescent are alone sufficient to account fully for the dynamics that are commonly observed in the behavior of this period. These center in changes in the balance of endocrine activity. Glands that have restrained sex development now release their control, and a new balance of endocrines results. The secondary sex characters appear, which make a boy look and act like a man and a girl look and act like a woman. Height and weight attest rapid physical growth. Awkwardness attests the irregularity of this physical development, some parts of the body developing sooner and more rapidly than others and leaving the previously organized patterns of behavior all awry. Patterns on the mental level, habits and concepts and interests, must be reincorporated because of these changes from within and their consequences in changed relations without. Parents and friends have a problem of their own in adjusting to this new personality who, in stepping out awkwardly into a new world, naturally steps on many people's toes. Here, indeed, is need of a saving sense of humor and an intelligent understanding of the problems of development.

Too often, the needed social relations are found anything but cooperative and intelligent, particularly with reference to sex problems. Sex development is normal, and the related problems of emotional adjustment will be normal if normal social relations can be had between parents and children and in other social contacts. Years of gradually developing insight into sex life should have characterized the earlier life of the youngster, and if this has been the order of development the youth arrives

at this period disposed to seek information as the need arises. He is disposed to be an intelligent director of the adjustment that he is making and is thus best able to maintain the cooperative social relations through which he may continue a normal development.

Tragedies of Later Life Result from Failures in Social Development.—Nature exacts its price for failures to make normal adjustments. Many failures in the adjustments of the adolescent may be classed as failures in social development. Parents, often without realizing it, are shielding themselves from the fact that their child is becoming an independent man or woman. Many evidences are constantly before us of this unwholesome bondage of parent-child relations, persisting not only well into adolescence but continuing sometimes throughout life. Here is a father who would have his son follow in his footsteps professionally, in the face not only of obvious unfitness but also of dominant and constructive interests in some other field in which the youth might be expected to excel. Here is a mother who persists in trying to make a musical success of a daughter who does not have the necessary special abilities to warrant the venture; the mother is trying to fulfill in the life of her child a thwarted ambition of her own youth. Here is a parent who pretends to be ill, and indeed may become ill, thus holding the grown offspring close at hand and involved in a plethora of affected affections which lull the urge of youth to be meeting life courageously on his own. Here is a parent obstructing the marriage of a son or a daughter, giving reasons that are but a poor mask for their own tyranny of unwise affections. Here are young men and women leaving home to go to college or to take their place in the workaday world, torn to the bottom of their souls by a separation that should at its best be as natural as the breathing of free air. At the base of these unworthy alliances is the failure to respect developing personality. Such respect should start at birth and continue throughout life.

The Nature of Complexes.—In youth as in other periods in life, human beings face both the adjustments that arise from inner change and trying situations in the outer environment. Some issues are subject to intelligent control, but some are unyielding and persistent and at times fairly make war upon the individual and tend to disorganize his life and break his spirit. The thalamic-visceral organization in its very nature is assertive and dynamic if it can be; if it cannot, it may turn tail in a manner that is as unreasoned as is its aggressiveness. Nature provides for the smoothing of the road of life through all sorts of compensatory adjustments in which a greater or less degree of intelligence is incorporated, in which the alliances between the intelligent and the emotional are sometimes wholesome and sometimes unwholesome. As has been seen in previous chapters, habits are products of varied experience out of which the consistencies take pattern as generalizations that are capable of influencing future behavior. So it is in these good and bad alliances between the intelligent and the emotional.

The three sons previously used as examples serve to show the effect of such alliances on the lives of individuals. Out of the varied experiences of the three mother-son relations, there came organizations of behavior patterns that persist and become a part of the character and personality of the sons. The first son has long been on the road to becoming timid and retiring. The second son has long been on the road to becoming furtive and deceptive. The third son has his honesty and social adaptability rooted in living that is in kind with these habits of life. The second son travels his road of life and has the habit of detours. Instead of an intelligent resolution of issues as they arise, he lets people "run down" and later does as he pleases. Some day, perhaps in the reorganization of the adolescent period, he may take a stand and tell his mother that he is going to be his own boss. Open conflict may arise from the issue thus brought to a climax and end in his running away

from home. Such climaxes may lead to self-destruction in the case of timid individuals such as the first son.

These are tragic resolutions of emotional conflicts, but no less tragic are the habitual detours that are many times set in the character of individuals. *Complexes* is the name given to the compensatory habits that meet situations by detour. These patterns at their roots are emotional in character and are therefore powerful influences in determining behavior. They shield the individual from the unpleasant; they tend to "put a face" on things and make it appear that all is well when it is not. This detour substitution for reality is really evidence of the continued stress and maladjustment that exists between the basic emotional self and the intelligent organization of relations with outer circumstances.

The Nature of Sublimation.—In contrast with such habitual detour behaviors, note the wholesome character of the third son. The doors to normal adjustment are continuously opened to him by an intelligent mother and father so that a unity of the intelligent and the emotional is maintained. His life with his mother and father is cooperative; they are never unyielding and inflexible. A sense of humor comes to the rescue; it keeps life emotionally vital, it keeps it intelligent, it keeps it whole. Out of the fullness of this constructive life, the son grows strong in making the most of life, grows strong in his ability to give and take. As noted in previous pages, neither the higher rational organization nor the dynamic emotional may have their own way. The emotional in its own right rises to some degree of intelligence; it has at least "horse sense" and thus can come halfway when the higher intelligent organizations can do likewise. When both are induced into making the most of life, the emotional is given an outlet of expression that is essentially normal but that lifts the total of behavior to a higher level. This lifting and expanding of emotional patterns into wholesome alliance with the intelligent is commonly called *sublimation*. The world is full of fine

souls who have made the most of their lives in the face of adversity, but their number is matched by warped souls who know little or nothing of the open roads of life because they have the habit of detours. Life has at least three dimensions: there are ways of going up and over, ways of going around, and ways of going through. The up-and-over way of sublimation is better than the way of detours or that of pugnaciously going through.

Summary: How Can Man Make the Most of Life?—It must appear from the varied spheres of experience in which the cooperation of the emotional and the intelligent is essential to normal adjustment that this problem is of far-reaching significance in our lives. This is indeed the truth; normal adjustments of basic emotional and intelligent aspects are essential in the life of the individual, and these cannot be attained for the individual except through social cooperation. Thus, the problem reaches into the heart of social, economic, and political organization, all of which are concerned with satisfying the needs and enhancing the satisfactions of mankind.

The simplest answer to the question of how man can make the most of life might be through the very practical approach of satisfying his basic needs. To attain this end, man should avoid the extremes of heat and cold, keep out of situations that will cause him pain, provide for himself adequate food and shelter, seek congenial companions, get plenty of rest, and spend ample time and energy in the recreation and the creative pursuits from which he gets the most pleasure. Such an answer is not only too simple, but it evades the issue at every step, the issue being the organization of his relations with his material and social environment so that these things may be possible. Such relations call for control of the environment and of his own emotional nature. When one views the attainments that have come as a result of scientific knowledge and inventiveness, it seems easily within the reach of mankind to organize his environment for a high plane of

existence. We live in an age, however, in which the problems are not only those of production but likewise those of distribution. Recognition of the need of organizing our lives to make the products of our labor more available is evidenced in national and state measures for security and well-being. To be sure, present efforts may appear to some as but a beginning, but the direction taken is a definite recognition of the psychological problem of control of the conditions of life if it is to approximate the possibilities of worthy living. Those bending their efforts in such a cooperative enterprise find themselves definitely opposed by the proponents of individualism who profess little faith in cooperative measures and contend that it is man's nature to fight and flee, to dominate and to exercise his own abilities at the expense of opportunity for others. Thus, the issue of the good life becomes the age-old problem of control of the emotional nature of individuals by social organization.

The growth of civilization may be interpreted as showing that man can create social controls for his basic emotional nature. That is exactly the meaning of government, law, religion, and social custom. The problem is to match progressive change in these social controls with the fast-changing material environment and our clearer understanding of man's nature. There is need of recognizing not only the basic emotional nature of man but also the processes of sublimation which are quite as native to man's nature as his ability to control his environment. The problem resolves itself into three phases, the issue finally resting, as always, in the control of social relations. The three phases of the problem are as follows: (1) Can the control of the necessities of life related to food, warmth, shelter, and well-being be ordered in a manner to minimize the necessity of emotional conflict and thus make social cooperation easier? (2) Under such conditions, will it be found that man's native emotional patterns can be induced into a new order of life and give force, color, and verve to the

alliance of the emotional and the intelligent in human nature? (3) What are the kinds of social organization that will make the most use of material abundance and give the individual the satisfactions that arise from sound creative development? Such a life has long been set as the aim of religious ideals and political systems. In religion, it is stated in the golden rule of doing unto others as you would have them do unto you, and in political dogma it is found in declarations which assert that life, liberty, and the pursuit of happiness are the rights of every individual. Democracy confidently asserts the ability of man to live cooperatively, but undoubtedly we live in an age when this issue is being severely tested.

Education is the instrument through which society hopes to convert its ideals into the realities of life. One of the major objectives of education should be directed to the establishing of attitudes, interests, and understanding that will lead to wholesome emotional control. Several implications for such education arise from our discussion. It would appear that the child cannot be trained in really worth-while matters in intellect alone, for the issues of life drive through to the emotional in human nature. Education should be of the whole child; he should become capable of intelligently directing his emotional energies in the doing of worth-while things. Our discussion of the emotional organization of human beings points unmistakably to the field of social relations as the area of life in which the intelligent and the emotional are most pointedly involved. To meet the needs of the emotional development, education should be founded upon cooperative social relations between parents and children and between teachers and pupils. Nor will any shallow substitute for real cooperative living meet the needs. Children respond best to social situations in which there is mutual respect of personality. The life of school and home should be sufficiently flexible to make cooperative living possible. The younger generation should share in the planning of the group life and should be

given responsibility in accord with their developing abilities. They should learn to take initiative and to be resourceful in carrying the group plans into effect. They should share in the joys of success; they should share in the trials that come with meeting difficult problems; they should learn to take disappointment; they should learn to rise above failure and try again. These are matters of the emotional nature, the control of which arises from social situations in which intelligent purpose is joined with enthusiasms and trials and failures to make the individual strong in facing the problems of adaptive living.

In general, the implications of our study are that emotional behavior is subject to modification and control as is behavior of the more intellectual type. Man can develop a sense of humor. He can learn to take pride in the ability to see a situation from another angle. Even a two-year-old child can sense the need of self-imposed discipline so that he may live happily with others. Our study has pointed out that the character of our social relations is the key to success and failure in emotional adjustments, and social relations in turn should and can be a matter of intelligent determination. The consideration of these problems is continued in the next chapter, as we discuss the nature of "personality."

SUGGESTIONS FOR NOTEBOOK AND BULLETIN BOARD

1. Select from news items, or from news illustrations, records of instances in which maladjustments seem to have been due to lack of emotional control. Trace, where possible in such cases, the nature of social relations of childhood or later years that might be the explanation for the lack of emotional development. Compare such examples with sound adjustments in similar situations, pointing out the essential psychological and social differences in the two.
2. Select news items and illustrations which point to some of the emotional-adjustment problems of adolescence.

DIARY OF YOUR OBSERVATIONS

1. Observe and make a record of observed behaviors of some baby and its mother that show the basic physiological needs about which emotional behavior is organized. Note the character of the social relations that seem to be developing. What do they seem to imply for future relations when the child is older?
2. Record observed examples of types of emotional behavior that parallel those of the mother-son situations described. These may easily be obtained from observation in many schoolrooms and in many homes.
3. Make a record of cases of children that seem to be good examples of lack of psychological weaning.
4. Make a record in several short paragraphs of experiences of your childhood that you remember vividly because of their emotional content. Account for the fact that these are the particular situations that you now recall. Have these experiences operated distinctly for good or for bad in your life? Account for this influence in terms of relation to basic needs, if there be such a relation, or in terms of the social relations that were involved.

SUGGESTED READING

1. Chapter 21, entitled "Progressive Factors in Evolution," from Herrick, J. C., *Neurological Foundations of Human Behavior* (Henry Holt & Company, Inc., 1924), gives an interesting interpretation, from the point of view of a biologist, of the problem of social and material control of environment.
2. A book that records some interesting cases of problems of emotional control, reported by parents, is Adler, Alfred, *Guiding the Child on the Principles of Individual Psychology*, (Greenberg, Publisher, Inc., 1930). These reports show the interest that has developed in foreign centers of population in establishing clinics to which parents may go for help on such problems. Similar provisions are found in many American cities. What steps are taken in your community, either in connection with schools or otherwise, to give such service?
3. A book by Thorndike, E. L., and others, *The Psychology of Wants, Interests, and Attitudes* (D. Appleton-Century Com-

pany, Inc., 1934), gives the reports of extensive investigations in the field of learning in which emotional factors are involved. On page 212 will be found a summary which indicates that learning involving emotional factors is essentially like learning predominantly concerned with concepts and the formation of motor skills.

Chapter Sixteen

Personality

It appears that the word *personality* has a wide range of meaning. How often we hear such expressions as "He has no personality" or "She is lacking in personality." Asked to explain what is meant by personality some people turn to a dynamic leader of the community as an example and say, "There is real personality." A teacher in high school will tell you that he is dealing with youth at an age when personality is in its most formative stage, and the kindergarten teacher will vie with the high-school teacher in declaring that at four and five years of age the development of the child's personality is most significant. Others will assert that the foundations of personality are laid in still earlier years of life. It is plain that personality is intimately related to the impression that one person makes upon another; yet none of us will agree that we are only what others think us to be, even though we are forced at times to admit that we may not be what we think ourselves to be. All of this makes an interesting problem of determining what personality is, or at least how we may think about it.

Several Ways of Viewing Personality.—The problem of interpreting personality, like that of interpreting any aspect of human behavior, is in part a matter of selecting a point of view. We can look at the matter objectively and say that our personality is what we do as it bears

on our relations to other people. Another view leads us to say we are what we are, implying that what we are is much more than what we do in our relations to others. Still another view would go further and say that the most significant aspects of our personality are the factors about which we ourselves know little—the hidden motives that influence our actions and our character, motives that are not raised to the state of consciousness. Still another point of view, characteristic of the interpretation in previous chapters, would attempt to encompass all these by asking how personality manifests itself, both inwardly in personal experience and outwardly in social behavior, and how these two aspects come to be organized in the unity of life as we know it.

Personality Viewed Objectively.—Irrespective of the mode of approach, the subject for study is the same and the results of one approach tend to approximate those of another. We see this, for example, in the definition of Dashiell who says, "A man's personality—we may conclude—is his system of reactions and reaction-possibilities in toto as viewed by fellow-members of society. It is the sum total of behavior trends manifested in his social adjustments."[1] At first, this definition seems unduly dependent upon the objective behavior that can be viewed by others in the course of social contacts. We note, however, that it includes not only a person's reactions but his "reaction-possibilities" and his "behavior trends." The inclusion of these possibilities and trends carries the implication that the personality is something more than what is actually observed. This broader interpretation is assured when we note that Dashiell extends the range of social adjustments to include man's relations to animals and gives as examples the man who beats his dog and the woman who pets her cat. Then he goes further to include relations with inanimate things treated as though they

[1] Dashiell, J. F., *Fundamentals of Objective Psychology*, p. 551, Houghton Mifflin Company, 1928.

were alive and gives as an example the man who throws the hammer away as though it were responsible for hitting his thumb.

Relational View of Personality.—Having gone thus far in relating man dynamically to the objective world of fellow men, animals, and objects, one might ask Dashiell to take the remaining step that is consistent with his definition. Must it not be granted that, if any object of our environment is a part of the stream of experience and has meaning, it thereby becomes dynamically related to us through experience? In other words, do we not treat all inanimate objects as though they were party to experience? The man hits his thumb with a hammer and throws the hammer into the corner; he may even say things to it—indeed, he probably does, under such circumstances. But is not this highly dramatic performance essentially like all our relations with hammers, except that in this performance the hammer is playing the role of the villain rather than the usual one of a servant?

How do we treat all the objective world? The answer to this question is to be found in the nature of our concepts, for they represent the established relations that have grown out of past experience and are guides in the patterning of our present experience. We have found that concepts of self are formed with relational dispositions toward people and objects that have been involved in the experiences from which the concept of self arose. The concepts of people and things have arisen from the same experiences and are relationally disposed to self; they are *ours*. Not content with the abstraction of self and of the objective world in these relational dispositions, the mental processes pull out from our experiences concepts of the relations; we come to think of the ups and downs, the befores and afters, the whys and wherefores, and these relational concepts are in their meaning related to both the self and to the objective world. One needs but to look firsthand upon the nature of experience to verify these facts. The book we hold

is conceived as pulling downward and away from us. A baseball hit by a batter holds a dynamic relation not only in the experience of the batter but in the experience of everyone who looks on. Not only does bat react upon ball, but ball reacts upon bat; and it is so conceived by the observer—felt in terms of his own past experience.

So with the hammer thrown in the corner. At all times when that hammer is a part of our experience, it is a "person of the drama" in the sense that it is conceived and therefore experienced as in dynamic relation to us. It is lifted by our effort working against its downward pull, and we strike with it by adding our effort to its downward pull; it is sensed as joining with us in impelling the nail into the wood, and the wood is felt and experienced as giving resistance to the nail and to our effort. The more obviously dramatic throwing of the hammer into the corner and calling it names are an overt manifestation of the basic relational aspect of the firsthand experience and of concepts that have been organized out of similar experiences. Our concepts of ourselves are disposed dynamically to the outside world. We conceive of the outside world as dynamically disposed toward us, and our concepts of relations between these outer and inner aspects of experience are dynamic and relational in character—all in keeping with the experience from which they arose as generalizations. The up and down of the hammer is definitely related to the up and down of our arm, a more telling fact in experience than our calling the hammer names when we assume only that it may answer back. We may safely conclude that our personality has to do with our relations with the outside world, including the world of things as well as people and animals.

Personality in the Making.—Throughout our study of human behavior, we have found the factors of heredity and environment closely interrelated as they operate in the process of development. We are born individuals, and differences in our material and social environment make

us still more individualized. When we try to account for what we are, we are faced with a complex problem in which we can discern many influences at work. There are those basic factors which make us human beings, like other human beings in fundamental body structure and behavior. There are also the hereditary factors of race and family represented in the individual by the old-brain and endocrine systems that are basic to emotional traits. These basic emotional patterns become so quickly and effectively interrelated with the culture factors of our environment that we cannot easily separate the two. The child from birth is caught up in a cultural stream of incredible power, the circumstances of his life opening or closing to him many possibilities of development. During the period of childhood and youth, he accepts not only the food, clothing, and shelter that are essential to physical development, but also, with these, the language, modes of thought, attitudes, concepts, ideals, and aspirations of race and community and family as these are woven through his social experience into the warp and woof of developing personality.

Why Are Social Relations So Potent?—We talk to hammers, but they do not respond. We speak to our pet animals, and they respond within a very limited range of reactions. We speak to our fellow human beings who know our language, and they speak back to us. Conversation is a reciprocal stimulation in which understanding develops with the changing thought processes of the two or more people so engaged. It is the old story of two heads being better than one. We do not get far talking to a horse or dog, however smart he may be, and our conversation with the hammer turns back upon us and becomes a soliloquy. The hammer is useful as a tool but remains only a tool and does not actively contribute to the progress of our work except as we use it. The horse does as we bid him through symbols of words and pull of reins, but the limits of his intelligent adaptation are restricted. Our human companions, however, join with us in the relations of thought

building, which transcend the levels of tools and beasts. The unique potency of social relations lies in this interrelation of the thought process of the members of the group. The contribution of one member becomes, through the expression of his thought, the stimulus to other members. The hammer is useful but not cooperative. The horse is alive and contributes expected and unexpected behavior, but the new and unexpected are not likely to be helpful. Our friend, however, is not only alive but continuously contributing suggestions and constructive efforts to our common enterprise. To our proposals, our friend adds a progressive quota to make a unity in which he merges himself as he shares with us the common experience of facing problems, finding means to an end, widening the range of our understanding and clarifying our purposes and goals.

A Social Group Is an Organic Unity.—Have you noticed a number of people become a social group? Merely being together does not mean that there is a social group. Sometimes, people who are together remain just so many isolated individuals, warranting the common expression, "They act like sticks." They chance to be together, but they do not get organized with respect to any common motive. Everyone has seen at some time in his life such a mass of individuals become a social group. For example, strangers on the street may see an automobile accident. Now, note the process that brings them into group relation as common stimulus begets something of similarity in response. As individuals they run to the scene of the accident, each bent on satisfying his curiosity. Once at the immediate scene of the accident, there are things to be done. Someone starts to do something; he needs assistance which is immediately given. Then, other things are to be done; presently, an individual assumes the role of leader while others fall in with the directions given, making suggestions perhaps, exercising discretion and independence in the particular parts of the work upon which they are

engaged, but coordinating efforts to greater or less degree in the direction of common purpose.

The behavior of such a group is developmental in character; it changes from an unorganized to an organized whole. The individuals who constitute the separate parts work together; the group activity gathers dynamics as it takes the direction of a common purpose. The work of parts becomes differentiated in character but coordinated with other parts to give unity to the group activity. The dominance of some parts relative to other parts is to be found in the development of leadership and the acceptance of this leadership by the members of the group. Direction of the group activity is a function both of assertion of leadership and the intelligent acceptance of leadership by the individual members, each sensitive both to the independence that is his and to the relations that make it possible for him to do the things he can do best in furthering the common purpose of the group.

It is interesting to note how social groups may be disrupted by the failure of any of these essential factors. The necessity of a means of communication is obvious, demonstrated in the difficulty of organizing a group containing people of different languages. The loss of a leader will many times disrupt the organization; but leadership is inherent in any dynamic organization, and the most active element in the whole will soon show itself in the capacity of leadership. The new leadership may be good, bad, or indifferent, but it provides nonetheless the essential character of dominance about which the activity of the members of the group becomes coordinated. Failure in coordination we find due at times to multiplicity of leadership. This may arise from multiplicity of stimuli, as is the case when there are too many things to be done at once. The solution of such a dilemma verifies the applicability of organic principles to group behavior: perhaps the group accepts the leadership of one faction and sacrifices the other; perhaps the dominant elements are induced to

compromise on some new plan of action, thus giving coordinated direction to the activities of all; perhaps the group divides to form two new groups, each of which has the essential characteristics of organic unity.

The principles of organic unity are operative in all social contacts, in a person meeting a stranger, in the organization of the neighborhood children in back-yard enterprises, in the formulation of the constitutions and bylaws of a high-school club, in the organization of the life of our homes, and in our government. Particularly at this time, when the world is brought together by means of rapid communication and trade, do we find the whole of mankind drawn into an interdependent unit. The implications of social organization to the individual personalities that make up such a group are obviously of fundamental importance.

Personality as a Social Differentiation.—Robinson Crusoe isolated on the island was put in an interesting situation, interesting to him and interesting to us in our study of personality. In keeping with the demands of hunger and warmth and in line with the first law of nature, his first concern was with food, clothing, and shelter. But what of the other motives which arose from his social and cultural training? Did he measure his plans and his actions with reference to Friday, the only other human being present, to the standards of his past life, or to the expectancy of a social accounting when he would be rescued and would be telling others how he met his problems? To what degree was his behavior a projection of himself into the future? Or was his behavior a projection of his former self with attitudes and habits of his past life dictating his behavior? Did the absence of customary social contacts give him a sense of loss, or was he so constituted and so bound by the social relations of his past life that this chance to be on his own was found stimulating rather than depressing? Suffice it to say that Robinson Crusoe has remained an interesting character in literature and the

situation of being cast away upon an uninhabited island continues to be a plot of absorbing interest in fiction because the isolation reveals uniquely the dependence of personality upon the world of social and material relations.

One does not need to be shipwrecked on a desert island to feel the force of social relations in one's life. Does the reader recall the difficulty he had when, as a young child, he went alone to visit relatives for a few days, leaving behind him the usual environment? What an experience in adjustment such an occasion affords! We find a great variation in such adjustments as we compare one personality with another. The forward, willful youngster exploits this new situation, using it as a proving ground in which he can show off his independence and self-assurance. The timid child may become acutely homesick, and the only cure for a serious situation may be his return to his home circle. The sensitive, intelligent boy may be filled with wonder and curiosity and gradually try things out, watchfully appraising the approval and disapproval of his relatives. Some children, even though the change in environment be marked, will adjust so easily and effectively to their new experience that their elders remark that they can "make themselves quite at home" in any situation.

Instead of reverting to our childhood for evidence, more recent adjustments of the reader may be considered. Such adjustments are made when one moves to a new city, leaves home to enter college, or is initiated into new work. We see examples of personality adaptations in the difficulties that attend changes of school routine. For example, pupils who enter high school find that their day involves four subjects instead of seven or eight, several teachers instead of one, moving from one classroom to another instead of being at home in one room, having the responsibility and freedom that goes with free study periods and extracurricular activities rather than being under the immediate guidance of a single teacher. Such situations reveal the fact that personality, in its development and

in its continuity and integrity, is dependent upon social relations and upon the cultural environment.

We are born into a social and cultural environment; we develop in such an environment. In adapting to our environment, it becomes a part of us and we become a part of it as we project ourselves into relations with people and things, through play and work, through plans and aspirations and ambitions. What better conception of personality is to be found than that of an individual who has become a differentiated being through social experience? What more enlightening concept can we have of a well-developed individual than that of *a well-differentiated social personality?* From this point of view, a personality would be conceived as a unit within the larger whole of society, with the development and the maintenance of individuality dependent upon cooperative relations to other units. As a differentiated unit in the larger whole, each individual differs from others. What better basis for the interpretation of the successes and the failures of developing personality than this one of organic relation in the larger social group? What better basis for understanding the maladjustments of personalities that we see about us all too frequently?

Disintegration of Personality.—Personality tends to maintain its unity, but at times we see lack of unity manifest in signs of disintegration of personality. Setting aside causes of disintegration that arise from disease, injury, and old age, we find much valuable evidence of the nature of personality in its failures to maintain its integrity. The most commonly observed upsets are those temporary lapses in customary behavior that accompany the facing of unusual and harassing situations. Fear, anger, or some other state that arises from a highly emotional experience may serve to unsettle the habits that have been the ballast keeping the personality in balance. Jimmie, for example, may come into the house from an exciting game of ball, or perhaps he has had a fight with another boy, and his

(*Courtesy of Los Angeles Public Schools.*)

Breaking Up a Vicious Circle of Speech Defect–Social Maladjustment–Timidity; the Remedy Involves the Whole Personality as Helpful Social Relations and Speech Correction Build Confidence.

mother finds it necessary to say to him, "See here, Son, you must quiet down and get hold of yourself." Obviously, we are continuously meeting situations and establishing and maintaining relations with other people that exert greater or less influence upon us, and we may expect some of these experiences to be more potent than others in causing temporary maladjustments. If persistent, such maladjustments may change the course of our lives and the character of our personality.

We have noted in a previous chapter how Molly's failures in arithmetic had become set in attitudes that had arisen, in part at least, from the unwise sympathy of her parents. One after another of her failures had been smoothed over by her parents in ways that had resulted in the development of a defeatist attitude in Molly toward the study of arithmetic. This continued until the mere mention of the subject got a response from Molly that was quite out of keeping with her usual positive and confident self. Here was one phase of Molly's personality that was not consistent with the remainder. Here was one set of relations with the world about her that was not organized consistently with the remainder of her relations.

There was also the case of Dick, who had difficulty with reading, due in part to the pressure put upon him by his grandmother, his father, and his teachers, who frequently compared him disparagingly with his younger brother. Under such conditions, children, and their elders, too, develop spots in which they are very sensitive; to protect themselves they set up many kinds of defenses and detours to shield themselves from these painful experiences. These defense mechanisms, although they give evidence of the forces at work tending to disintegrate personality, show at the same time the persistency and the dynamics that are normally at work preserving its integrity.

Defense Mechanisms: Alibis and Excuses.—Alibis and excuses are with us every hour of the day in one form or another. We are forever mixing straightforward thinking,

which leads to sound understanding, with rationalization, which puts a face on things. Rationalization is not reasoning; rather, it makes our thinking look like reasoning when it is not. This false organization of the facts is designed to make them hurt less and leave us more at peace. Alibi, in its root meaning, is a term well-fitted to such situations since it is derived from the Latin *alius* meaning *other*. In the process of finding excuses and rationalizing, we are for the time being substituting another for ourselves. Molly's alibi in arithmetic situations was that she was a member of a perfectly good family, both sides of which were "just short in mathematics." In this way, she created another self by hiding behind a father and mother who were respected, and grown-up, and successful in a proved way. By this hocus-pocus of rationalization she could quite make herself believe it to be the truth when she said, "Arithmetic doesn't get you any place in life. Pooh! Who cares about arithmetic?" Dick had constructed no alibi such as this in meeting his reading difficulty. He had the choice of suffering through these situations or of developing something in the nature of mental and social callousness. He was a sensitive and conscientious youngster, however, and the vicious circle of his failure, which stimulated the pressure from parents and teachers, which in turn helped set the stage for more failure, created a situation that was on its way to doing serious damage by undermining his basic self-confidence.

Compensatory Adjustments, Bad and Good.—A boy different in nature from Dick might have assumed an attitude of braggadocio toward his failure in reading. Such a boy would probably proclaim loudly that he "didn't care anyway," or he might turn in scorn upon his classmates and gain control over the group by asserting that they were "sissies for doing that silly old reading." Such a youngster, if he has the physical prowess, may maintain this position of dominance by thrashing any boy who persists in teasing him. The teacher in such a situation may find herself busy

trying to curb the antics of this youngster, who diverts attention away from reading and at the same time maintains his position of dominance with the boys whose good opinion he prizes.

How easy it is for a teacher or parent unwittingly to fortify a youngster in such a game and thus lead to undesirable developments in his personality! On the other hand, how easily some teachers and parents understand the situation and, perhaps by merely refusing to play the expected role of the villain, upset the whole plan! If the youngster is successful in his defensive technique, he tries it again and again, and we may soon have a really different boy to deal with. The persistence of such experiences may lead to fundamental changes in his outlook on life, and undesirable traits may become a part of his personality.

It has been suggested that Molly should have been taken to her father's office where she could face some of her false thinking about arithmetic. She would have found that her father did use much arithmetic. The facts were that both her father and mother had learned much in handling numbers and made much use of them in their everyday life. Molly needed to face these facts honestly. To be sure, there were limitations to her ability, and it is granted that disregard for such limitations may cause teachers and parents and schoolmates to create distressing situations which lead to rationalizations and alibi attitudes. We can say that intelligence was used by those who were helping Molly and Dick resolve these tensely knotted behavior patterns. Intelligent handling of the situation made possible the intelligent attack upon their problems by Molly and Dick themselves. Dick had reading ability that had not developed, and the first step out of his difficulty was placing him with a teacher who would give him sympathetic understanding, who would help him establish the morale necessary for doing something constructive about his problem. His grandmother and father were made intelligent parties to the constructive program,

at least to the extent of letting Dick and his reading alone. The actual help given Dick by the teacher was not paraded before his class where he might have been put to shame for his failures.

Nothing succeeds like success; in a case like Dick's the first successes may be small, but they must be sure. In Dick's case, his success in art became the basis for success in reading, since through it he gained a sense of his worth in the life of the school group. Morale for making positive attack upon his reading arose out of the general esteem in which he was held by his fellows and by his teacher. Dick had more natural ability in art than in any other line, and in the eyes of his fellows he compensated for other limitations through this avenue. This is a legitimate and constructive type of compensation; it gave Dick membership in the social group through his contributions along the lines of his greatest ability. Having established such a relation, he had social elbowroom in which he could face his limitations. Then he could be honest with himself because he could afford to be honest with others. Group living is compensatory; we give the individual worthy membership in the activity of the group on the basis of his unique contribution, and in a way the group becomes allied with him in facing the problem of his shortcomings. The members of Dick's group could do this honestly because, though he was given his best opportunity, the other members of the group were likewise given their opportunities for making unique contributions. Such a differentiated and at the same time cooperative group life furnishes the kind of experiences through which personality can develop and maintain its integrity.

Extreme Cases of Maladjusted Personality.—Often, habits of rationalization, alibis, and other defensive mechanisms become established without the subject being fully conscious of what is happening. In the very nature of the circumstances, there is a tendency to cover up what is happening, because by so doing the person is shielded

from the painful experience of facing the issue. We are dealing here with conditions that persistently create powerful tensions. As indicated in the last chapter these tensions arise when the dynamics of basic emotional patterns are in conflict with outer circumstances to which the person cannot adapt intelligently. Under such tensions, there is naturally a deep stirring of the behavior patterns that lie at the foundation of personality. If intelligence and emotion are not induced into wholesome cooperation, the adjustments become essentially an armistice between the established personality and the forces that create the distress. If this armistice were an honest, aboveboard, intelligent postponement of the issue, all might be well, but not so when it is a cloak to hide conflicting elements within the personality.

A Case of Dual Personality.—The recital of the essential facts of a specific case of dual personality will show that the same dynamics of personality and the same general method of protecting it are at work in these extreme cases as in less dramatic conflicts. The case chosen for our example was reported by Goddard.[1] Norma was the oldest girl in a happy but rather poor family, in which she grew up as a responsible and conscientious member. Norma was not strong physically, and she was faced with a succession of tragic circumstances, first the death of a twin sister and then the death of her father. Shortly after, the mother became ill and was placed in a sanitarium. The home was broken up and the five younger children sent to live with relatives. Norma now had no permanent home but secured work where she could. Naturally, she had many adjustments to make in her new life, separated as she was from the other children and her old acquaintances and surround-

[1] Goddard, H. H., "A Case of Dual Personality," *Journal of Abnormal and Social Psychology*, Vol. 21, No. 2, pp. 170 *ff*. Briefly reported in Menninger, Karl A., *The Human Mind*, pp. 236 *ff*., Alfred A. Knopf, Inc., 1931. See also Wheeler, R. H., *Readings in Psychology*, pp. 149–174, The Thomas Y. Crowell Company, 1930.

ings. She worked in one home that was particularly unfortunate in its influences. At about this time, her mother died. Norma was then seventeen. She began to walk in her sleep and was locked in her room at night to protect her from injury. This increased the strain, and she began to faint and fall into heavy sleep. She was placed in a home for wayward girls where she spent 3½ months in an environment that was utterly out of keeping with her need for rest and where for the first time in her life she was faced with issues of a moral nature. She was then placed in a home where she had the care of a small boy and was relatively content. For two successive years, she spent her vacation in her old home community, with relatives into whose home her little sister Polly had been taken as a member of the family. On her second vacation, she was particularly happy with old friends and with Polly, who was now four years old and living a happy, carefree life in sharp contrast to that which Norma had lived. Her sleepwalking returned during this visit, and a few days before she was to return to her work, she fell asleep and woke as Polly. She was shortly brought to the mental clinic, where for some days she alternated between the Polly personality and one that represented herself at fifteen and sixteen years of age, though she was then nineteen years old. She would fall into a coma, sleep, and then waken as the other personality. When she woke as Polly, her behavior was that of the carefree sister. Her talk was babyish and ungrammatical, and she tested four years in intelligence. When she represented her fifteen-year-old self, she tested fifteen years in intelligence, and her behavior was consistent with such a mental development. The clinic was presented with the problem of bringing the fifteen-year Norma to a stable nineteen-year personality and doing away with the patterns that opened for her an escape into the Polly personality.

Restoring the Integrity of Personality.—The mode of procedure in restoring Norma to mental health was in

its essentials no different from that of remedying Dick's difficulty in reading. The first step in such cases is to find the root of the distress. The cause of Norma's condition was not difficult to determine. Often, however, it is very difficult to find the root of such disturbances. The initial cause may lie in some distressing incident of early childhood. In the course of time, a well-established complex and a detour pattern may become established. These complexes, as described in the last chapter, become hidden, but the unresolved emotional stress still exerts a powerful influence upon the individual's life, often causing serious physical illness. If the normal outlet of expression and adjustment has been persistently closed, the emotional dynamics seem increased by being bottled up. Norma was unable to adjust herself to the new and sometimes distressing life she was forced to live. These new experiences were in conflict with her conceptions of herself, with her habits of life, and with her ideals of what she would like to be. The realities of her life were in continuous conflict with her personality. She had no one into whose ear she could pour her troubles and no way by which she could resolve the tension and construct an intelligent way out; so she finally deserted the battleground by becoming Polly.

When Norma was placed in the hands of the clinic, months of remedial effort were directed to getting her to resume the battle by building confidence in her ability to succeed. Before this could be done, however, she had to face the issue of having deserted her old self for the Polly personality. The two personalities in the same physical organism had to get acquainted with each other, reason things out in a way that would make the Norma personality permanent and dominant. When Norma was herself, she was somewhat aware that she was in the habit of becoming Polly but remembered little about it. When she was Polly, she knew nothing of Norma. Later situations developed which created inconsistencies that forced readjustments in both patterns. The record of this case is not complete,

but we may be sure that efforts were continued to develop a unified personality with sufficient confidence and stability to face life constructively.

Such psychopathic cases are extreme manifestations of what we find common to everyday experience. Parents and teachers are continuously appealing to a child's better self in a way that implies a recognition of fairly well-organized patterns within the larger personality, patterns that may be quite inconsistent with the larger personality. We hear of people who are one thing in business life and quite another at home. To some degree at least, such differences in relations are justified by circumstances, the home possibly being more carefully organized and more worthy of confidence that can be given and shared, whereas the business world is but slowly emerging from the *caveat emptor* ethics of the past. If the environment does not permit a happy, normal adjustment, the dynamic personality protects itself by evasions, by rationalizations that make things look acceptable when they are not, by defensive mechanisms such as bluffing and alibi, and, in extreme cases, by the desertion of the original personality for another.

However difficult the cure of such a case as that of Norma may be, the remedial methods are simple in their general nature and have a significant implication for those who would live a healthy mental life. The method used in the remedy centers in the effort to identify the experience that created the difficulty and to bring the light of reason to the issue that was side-stepped. When the issue is revealed, the emotional and the intelligent in the patient's life must be induced into making a cooperative and constructive alliance to serve as a practical basis for the future life of the patient. The implications for normal living obviously lie in the direction of developing and maintaining an integrated personality by courageously facing issues as they arise, learning to gauge one's abilities, being happy in successes, and meeting reverses with some

reserve of self-confidence and esteem that will make a reasonable adjustment. The importance of sound social relations in meeting such issues is clear, for it is in our living with other people that we develop the ideals and purposes through which our personality is projected into the future with honesty and courage and earnestness.

The study of personality has not always been accepted as a legitimate part of the science of psychology. The first workers in the field of personality were not greatly concerned about their status. Breuer and Freud,[1] working as physicians in Vienna, and later Jung and Adler, may be taken as the founders of the psychoanalytic movement. Their work was first of a practical nature, and their theory grew out of their work. They found that physical illness was sometimes based on mental causes, and these mental causes took them repeatedly into the problems of the emotional life. Today, psychology looks to two main streams of development for its most significant data; one comes from the experimental psychologists whose contribution has been most significant in the field of the intellectual life, and the other from the workers of the psychoanalytical school who have forced the issue of the emotional life as it is related to the practical affairs of life. The contributions of the biologist and the physiologist have helped to bring the two streams of thought together.

Summary: Educational Implications of the Psychology of Personality.—Changes in educational thought and practice in both homes and schools reflect increased respect for individuality and personality. Relations between parents and children in our homes have changed from an old regime of dominance of parents and unquestioning submission of children to more wholesome cooperative group life, in which the developing personality is fully respected even in the earliest years of childhood. The growth of kindergartens and other preschool organizations is evidence of a

[1] Freud, Sigmund, "History of the Psychoanalytic Movement," *Psychoanalytic Review*, Vol. 3, pp. 406–454, 1916.

better understanding of the importance of the early years of development. As members of social groups, children are given responsibility in keeping with their individual natures and their developing abilities. Out of the relations so established we have come to expect a type of inner discipline and control to take the place of obedience to authority, which once was relied upon for the building of character. In middle childhood and in youth, we see a wide expansion of organizations (such as boys' and girls' clubs, Scout organizations, sports) and the encouragement of individual abilities in creative efforts in art, music, and other activities, all of which permit the individual to have the joy of successful participation in the fields that are of greatest interest to him. In our schools and homes, we find the more formal educational efforts broadened and enriched with materials and experiences dealing more and more with real life and human relations. The tool subjects which once dominated and routinized the educational program have, in our best schools, at least, become subordinated to enriched experience and vitalized through their functional relations of means for the accomplishment of goals and purposes in which children give fuller measures of their enthusiasm and interest.

Thus, children and youth are taking their places as junior members in the larger schemes of life. In the home, in churches, and on the playgrounds, they take their parts within the limits of their developing abilities and to the extent that wise organization of these agencies gives opportunity. Children come to school with a keen sense of its being the door opening to their playing an ever larger part in the drama of life. More and more, the life of our schoolrooms capitalizes this sense of relation between life in school and outside; more and more, the schools draw upon the activities of the community for their educational materials.

In this developing educational movement, there is acknowledged the fundamental relation between living and

learning. Knowledge and skills are conceived in relation to developing personality, rather than as prescribed attainments with little relation to the interests of children. Effort is made by teachers and parents to organize in cooperation with children rich, vital experiences that will engage their normal interests and enthusiasms. The individual personality develops through its relations in an organic social unity that offers the opportunity for full development. In such a setting, we see Jimmie and Jane and the baby brother developing into well-rounded characters. In the companionship of his mother and his dog, we find a boy of five initiated into the meaning of charity through the incident of the November wind and the falling snow. Dick has no mother but finds a door opened to the solution of his reading problem by a sympathetic teacher. Molly's difficulties in arithmetic are rooted in relations with her parents. In the flux of social relations, children and adults alike find the conditions favoring or limiting the development and enhancement of personality. Personality is indeed a social differentiation, emerging from social experience, maintained in its integrity by virtue of social relations.

SUGGESTIONS FOR NOTEBOOK AND BULLETIN BOARD

1. Continuing the suggestions offered in the last two chapters, collect news items that illustrate psychopathic results of the emotional tension of modern life.
2. Organize in parallel columns illustrations of well- and ill-balanced personalities. As an alternative to the above suggestion, illustrate the two types of personality with single pictures, and for each type illustrate the contributing causes for the balance and lack of balance.
3. Have you read a short story, play, or novel, based on the shipwreck theme, such as Barrie, J. M., *The Admirable Crichton*, in which changes in social relations reveal the bearing they have on personalities? Trace briefly the effect of such changes upon personality in some story which you have read.

DIARY OF YOUR OBSERVATIONS

1. Record an example observed of the actual organization of a number of individuals into a social group. Indicate if possible the behavior that made the group an organic unity, including (*a*) the development of common direction and purpose, (*b*) the development of leadership which gave group unity to the activity, (*c*) the coordinated relations of individuals who worked as members of the group, (*d*) the opportunity for individual experience and development under such cooperative conditions, (*e*) the organic relation of individual activity and that of the group as a whole. What happens to group effort and to individual effort when these organic relations do not continue?
2. Make a study of the adjustments that some child makes when he becomes a member of the group in a schoolroom or neighborhood. What steps might an intelligent teacher or parent take to make such an adjustment easier and more effective? Point out the significance of the relational aspects of social behavior in the steps you suggest.
3. Keep a record of various defensive mechanisms and compensatory adjustments that you observe in your own behavior or in that of others.
4. Have you among your friends someone who is particularly capable of helping you resolve emotional stresses? Describe an occasion when this has been done, noting the way in which the emotional and intelligent factors were brought into accord to restore balance to your personality.

SUGGESTED READING

1. The reader will find interesting material on various aspects of the study of personality in Terman, L. M., and others, *Genetic Studies of Genius*, Vol. 3, (Stanford University Press, 1926). Chapter 60 is concerned with "Social and Personality Traits," and indicates some of the methods used in evaluating different phases of personality. Part 2 of this volume contains a wealth of material on individual children who have been studied over a period of years. The following chapter titles are suggestive of the content: "Three Gifted Girls," "The Conquest of Obstacles," "Behavior and Personality Problems,"

"Five Musicians," "Youthful Zealots," "The Promise of Babyhood and the Fulfillment of Youth." These records of successes and failures furnish excellent material for the study of individuality and personality.

2. Another source in which the practical study of personality is set forth is Zachary, Caroline, *Personality Adjustments of School Children* (Charles Scribner's Sons, 1929). This book presents the practical work of a school clinic in solving the troubles in which children and parents get entangled. The common-sense explanation of psychiatric cases is most wholesome. The implications for the education of the home and school emphasize social relations that are fully in keeping with the point of view of the last few chapters of our study.
3. In Heidbreder, E., *Seven Psychologies* (D. Appleton-Century Company, Inc., 1933), Chap. 10 gives an understandable survey of the analytical movement.
4. Seashore, R. H., and Barney Katz, in the *Psychological Record*, March, 1937, have given us "An Operational Definition and Classification of Mental Mechanisms." The classification of these "mechanisms" as socially approved and disapproved, tolerated and criticized, is in keeping with the foregoing interpretation of personality.
5. The work in the field of personality psychology is well represented by Wallin, J. E. W., *Personality Maladjustments and Mental Hygiene* (McGraw-Hill Book Company, Inc., 1935).

Chapter Seventeen

Esthetic Experience and the Creative Life

Our lives are essentially creative in their nature. The growth processes begin with the simple whole of one cell, and from this a more complex being is created. New patterns appear, and the whole behavior presents a continuously changing array of activities. The processes of maturation are likewise creative. In the activities connected with maturation are found the spontaneous qualities that we commonly associate with the creative efforts of the artist. From the earliest months of life, the child pours the force of his energy into the playful activities that bring new patterns of behavior to their fuller ripening. These experiences are emotional in their nature. He is not only intent, but also joyful and happy, in his efforts in consciously wriggling his fingers, in beginning to talk, and beginning to walk.

Learning is likewise creative. Jimmie's understanding of locomotives progresses with a developing interest and insight that presents a continuously new face. These processes of growth and maturation and learning are not so much like the business of laying bricks on bricks to make an immovable wall, as they are like the growing tree which develops roots and branches and buds and leaves not only new in themselves but renewing the life of the whole tree. Since life in its basic nature is creative, it is natural that

human beings should, at times at least, attain highly creative levels.

The Creative Tends To Extend the Range of Behavior.—The babe is born with a wide range of behaviors established or soon to be brought to an adequate state of performance. After a few weeks of becoming basically adjusted to his new environment, he strikes out upon periods of development. These carry him through infancy, with talking and walking to widen the range of his life; through childhood, in which he becomes one in a moving drama of social life; through youth, in which his aspirations and ambitions carry him still further afield and project his life more definitely into the future. Born an individual, he becomes more individualistic; from the inherited beginnings, a personality is created. Roots of this personality are nourished through the developing relations with many people. Through his social life, his basic emotional behaviors make alliances with developing intelligence, the one supplying the dynamics and the other evolving the direction for experiences that are forever reaching outward and upward to make life more and more satisfying. One experience leads to another, and the whole of life becomes an ever changing venture into new modes of living.

The Creative and the Artistic Arise Out of the Useful.—It is commonly thought that the work of the creative artist is of the order of divine inspiration. The artist's own view of this matter was recently expressed by one of our foremost novelists when he said that he had come to put little dependence upon inspiration. The better way, he said, was to sit down and go to work; this successful writer has learned to depend on his customary experiences and his techniques as the source of inspiration.[1] In other words, the artist through his experience develops specialized patterns which can be depended upon to open the way for his creative effort. The novelist implied that by sitting

[1] The same point of view is found in van Loon, Hendrik Willem, *The Arts*, pp. 15 *ff.*, Simon & Schuster, 1937.

down and going to work he gets these patterns organized. Even the sitting down in the familiar chair, reaching for pencil or the typewriter keyboard, the feel of paper may be sufficient to set the stage for higher orders of techniques that are essential to the work of the writer. From this point of view, it appears that the work of the artist differs from that of other people only in kind. The door is open to all to capitalize to some degree the best of inherited capacities through the development of skills and techniques which open the way to creative effort. Thus, though we vary in the nature and degree of inherited capacities, we have open to us some field of activity which represents the most favorable conditions for development. Though we may not become artists of a degree to warrant the title of genius, we may nevertheless develop the art of living.

We commonly think of the artist as the best example of creative worker, and since artists may become highly specialized in their creative work, we are prone to think of artistic activity and its products as set apart from the main stream of life. Such an interpretation is not warranted, for the artistic arises out of the basic needs of life.[1] Art is basically a part of everyday living, and it emerges out of the most practical settings. One observes in a museum case, for example, a skin scraper which was once the practical utensil of an Indian squaw. The scraper was constructed to tear the fat and flesh from the inner side of a raw hide. Stripped to its essentials, this utensil is a flattened piece of iron with wooden pieces attached to the upper part to afford a grip so that the scraping point may be forced into the hide. Here is the occasion for strict utility, but the esthetic bent in the worker has enhanced her toil by a creative experience. The wooden piece on one side of the handle is beautifully molded to fit the grasping fingers of the hand, and the piece on the other side extends up and over the end of the iron and is carved into a bear's head. Even in this last touch the artistic and the practical

[1] *Ibid.*, Chap. 1.

are blended into one, for the thumb will fit neatly between the ears of the carved head to make the downward thrust of the scraper more effective.

Primitive life is rich in such examples, in which the creative effort of the artist arises from the practical activities of life. Prehistoric man made drawings on cave walls,

(*Courtesy of American Museum of Natural History. From painting by Charles R. Knight under the direction of Henry Fairfield Osborn.*)

The Primitive Artist Was Concerned with Things Close to His Life: Cro-Magnon Artists in the Cavern of the Font-de-gaume, Dordogne, France.

representing the animals essential to his existence. The Navaho protects his wrist from the backlash of the bowstring with a piece of heavy leather, then adds a beautiful silver ornament which at the same time enhances its usefulness. We may not have exactly the same motives as the savage who created these utilitarian artistries, but many parallels may be found in our own experiences. Food seems more palatable when eaten from a table with fitting decorations. Homes and offices are planned and ordered to fit and give expression to the personalities of their owners. The creations of the architect, the landscape gardener, the city planner, the engineer, and many other professional workers are examples of this unity of the artistic and the useful. The impulse to perfect the useful leads to a refinement that approaches the artistic, and the addition of the artistic reacts to improve the useful. So it is in the

creation of a simple tool, and so it is in the creation of the beautiful skyscraper reared on its solid skeleton of steel and concrete.

Leisure and Creative Experience.—It is true that the artistic is an integral aspect of even the most useful and commonplace in life. It seems true, also, that the artist becomes an artist by capitalizing certain inherited capacities, that the natural processes of specializing skills and techniques and knowledge are the means by which he capitalizes his inherited capacities. Yet we may well believe that many a potential artist has never been developed and many another has found his efforts blocked by inhibitions. Just "sitting down and going to work," as was suggested by the novelist, does not always do the trick; furthermore, there may not be the opportunity to set aside the responsibilities of the workaday world to do the sitting. Historically, man has left a record which shows the relation between leisure and creative efforts in the growth of civilization. Man did little creative work when his whole time and energy were given to the essentials of self-preservation. The products of his first inventiveness released time and energy for more inventiveness and for the artistic. Leisure is necessary for artistic effort, but leisure means more than the mere release of time and energy. It implies an attitude of release from worry, a freeing of the mental processes which carries with it an emotional quality that opens the way for creative work. We may well believe that one of the techniques which the artist needs is that of setting aside the cares of life and permitting a wholesome flow of his energy into the channels of artistic effort.

This wholesome flow of energy implies the union of the emotional and intellectual which we find in intuitive experience. Such experience is common to everyday life. Intuition is the right name to apply to those situations in which we get "hunches" before we are definitely aware of what the "hunch" is. It applies to those experiences in which we find ourselves getting the "feel of the thing."

Jimmie senses the thrill of success in getting the knack of spinning a top or curving a ball before he has fully succeeded. The geometry teacher directs her students to sleep on the difficult problems, to get in mind the main points of difficulty and then retire with a sense of assurance that the solution will come easily in the morning. The hidden factors of Thorndike's experiments were operative, though the subjects were unaware of their presence. It needs but the evidence of our own experience to assure us that we see through situations when the emotional and the intellectual are nicely coordinated.

The Artist Helps Others Make Life Whole.—The artist in his specialization is always pushing out into new territory, and in trying to give expression to his experience he is interpreting life to others, showing them the possibilities for a fuller life. A particular artist, or a particular piece of art, may not present a rounded picture of life, but by explaining and interpreting some particular phase of life the artist opens the way to richer living for others. A beautiful lawn with shrubs well placed in relation to house and walks and drives does something for many others beside those responsible for the creation. The balance of color and form in a portrait may accentuate some characteristic in a way to open the eyes of observers to an understanding of human nature not otherwise realized. The tone harmony of a composer may awaken depths of emotional beauty that would otherwise be left untouched.

The highly specialized life that modern man lives in his highly specialized world leaves him in great need of balancing his one-sided existence. He is in need of hobbies in which he can use his leisure to create; the creative effort may be a commonplace one, but it can be carried out artistically and joyfully. Our friend who works with wood-carving tools in his basement is getting balance. His work may not be worthy of being called real art, but the 4-inch carved pieces that run along the top of the book-

shelves in his study are pleasing to the eye, enhance the shelves, and lend a touch to the study, and they make the study distinctively his. As a carver of wood, we may rate our friend an amateur; but he is not an amateur in his profession, and one may well believe he is better in his special calling because of his hobby. By creating in his hobby he himself is re-created, brought into a better rounded whole of living that makes himself and his friends better human beings.

Sometimes the artist is consciously trying to give this balance to life. The noted author previously referred to has said that once he fully believed in art for art's sake, but that for many years now he has worked with a different notion. The truer effort, he says, comes when there is something to be said, and said for the purpose of interpreting the larger meaning of life to thousands who live in a narrow routine. This author purposely writes his novels and plays to meet the need of making lives whole.

Philosophy of Life and the Art of Living.—In our complex modern life, there is need of consciously rounding our life to keep it whole. Hobbies and the vicarious experience gained from novels, poetry, biography, drama, paintings, music, and participating in and observing sports open the way to securing such balance. Experience in these fields may be spontaneous, giving emotional release, perhaps from the drive of physical toil or from the depression of worries or grief. Out of our actual and our vicarious experience there arises a philosophy of life, an orientation of our personality toward the lives we are living. Such a philosophy implies the intent to make something of an art of living; the days ahead are viewed in prospect as opening to opportunities for creative experience, and life is viewed expectantly and with confidence and with a certain zest that promises that each day will give some new outlook.

To some extent, everyone has a philosophy of life. Each has his own way of looking upon the business of living.

Even when circumstances seem to overwhelm the possibilities of creative living, people are found pulling themselves together to meet the emergency. They take recourse in the philosophy of life they have developed, getting assurance from the generalization that things might be worse, that if one but stands one's ground circumstances will change, that while you watch and wait there are many things to be done that are constructive and forward-looking. Philosophies of life tend toward the creative, toward making an art of living.

To be sure, such philosophies may turn out to be of the Pollyanna variety and may end in skimming the surface of real problems. Sometimes they turn into organized detours to compensate for the inability to meet situations constructively. The astonishing fact is, however, that adverse environmental circumstances do not preclude the organization of good philosophies of life. These can be found in the finest of homes and in the poorest of homes, where adversity seems to be made an occasion for the creation of a sound working philosophy. The oppression of poverty may be the occasion and prompting for dissolute living, but so, too, may be the unwise use of riches. Circumstances may be helpful, but more is needed than circumstances to round out a developing personality with a working philosophy.

Companionship with fellow men, community with creative beings through the appreciation of their artistic efforts, a release from the humdrum through hobbies, a drawing off to get perspective, a finding of self by losing of self in good works—these are some of the avenues through which the average human being can make something of an art of living, make life whole, more intelligent, more courageous, and happier.

Lessons from the Lives of Geniuses.—It is natural that we should look to the artist for our cues for artistic living. Like the artist, we have some native abilities that have greater potentialities than others and we should

develop them to make the most of our lives. A study by Cox[1] of the biographies of 300 artists, musicians, writers, and statesmen resulted in conclusions that are highly suggestive for any life. Briefly stated, her conclusions are as follows. First, most of the eminent men studied came from parentage that was above the average, and this hereditary advantage was accompanied by superior advantages of early environment and education. Both heredity and favorable environment are generally essential for the development of highly creative lives. Exceptions to this are found in the peculiar combination of inherited traits which may be sufficiently potent to offset the disadvantage of poor environment. Cases in point are Bunyan, who was the son of a tinker, Carlyle, who was the son of a mason, and Kant who was the son of a strap maker. A second conclusion that Cox draws from her study is that the particular ability of the individual may be unique but that the special potentialities are backed by a high level of general ability. The early lives of these eminent men show ample evidence of unusual levels of general intelligence. It appears that eminence is reached through specialization but that the specialization is built on a sound base of an intelligently organized life. A third generalization further emphasizes this interpretation. Cox's study of the youth of these eminent men led her to conclude that to achieve eminence youth must have more than high intellectual traits; it must have the strength and force of character that shows itself in persistence in motives and in effort. These men developed confidence in themselves in youth, and their creative ability showed itself early. Behind their special talents was the persistent force of strong interests, great zeal, and seriousness of purpose. One is forced to conclude from such a study that eminence is due, not to factors that are peculiar, but to the particular

[1] Cox, Catherine M., "The Early Mental Traits of Three Hundred Geniuses," *Genetic Studies of Genius*, edited by Terman, Lewis M., Vol. 2, pp. 215–219, Stanford University Press, 1926.

combination of hereditary and environmental factors that are organized in a persistent, forceful personality. These factors are common to all lives, and it is in matters of degree and of the combination of such factors that individuals differ.

We May Enjoy Art without Being Artists.—If we search for the avenues through which we may get enjoyment from living, we should note first of all that the appreciation of the beautiful is open to everyone. Nature is lavish in creations of beauty, in color and form of flowers, in music of birds and running water, in colorful sunsets, grandeur of mountains and seas, peaceful meadows. To these creations of the natural world are added the creations of man which make the useful more useful by the addition of the artistic, which make living more meaningful by interpreting human experience through the creative techniques of language and drama, form and color, and rhythm and tone. Thus, the creations of nature and the art of man combine to make possible a wonderfully rich life, not only for the few who create but for the many who can appreciate.

Without doubt, the average civilized man has only scratched the surface of the possibilities of satisfaction and joy that may come from his appreciation of the beautiful. Our outlook on life and our working philosophy of living do not always give appreciative experience a fitting place. Our working philosophy may be too greatly centered in the business of work and the work of business. Too often, art and the artistic are stripped from life by social mores. Thus, little girls are discouraged by elders from their preference for colorful dresses; thus, little boys may come to look upon singing as "sissy" business; thus, poetry persists, in the attitudes of businessmen, as "a waste of time." Thus, men grow rich, but old; and finally, when the gleam of wisdom seeps from the mass of experience, they go about the business of compensating for narrow lives by endowing libraries, musical towers, and foundations of learning for the enrichment of the lives of others.

Undoubtedly, there have been periods in history when art was closer to life than now. The dance of the savage was knit into the purposes of the hunt and tribal protection. His ceremonies were artistic propitiations of the forces

(*Courtesy of Los Angeles Public Schools.*)

We May Enjoy Art without Being Artists; the Puppet Show Is a Fine Art Experience for All Concerned.

of nature and closely related to his immediate welfare. His art was not a thing apart. The creator and the appreciator were drawn close together in this unity of practical living. Common observation should convince us that there is indeed a universal appeal to human nature through artistic channels.

Experimental Study of Esthetic Experience.—The scientific studies of creative experience and of artistic appreciation have just begun. Enough has been done, however, fully to justify certain conclusions and to point the direction for organizing our thinking about this important aspect

of human experience. The development of this chapter has thus far rested largely on common experience and everyday observation, but it is in keeping with the results of experimentation which are reviewed in pages that follow.

It has been too commonly believed that ability to appreciate art and creative ability are possessed by only a few. The experimental evidence shows that ability to appreciate is distributed much as other abilities are. Carroll,[1] for example, found that the distribution of scores of 3,000 senior high-school pupils on the Carroll Prose Appreciation Test approximated the normal curve, with few at the two extremes and many in the middle range of ability. Tests that approximate a measure of native abilities such as the Seashore tests of Pitch and Tonal Memory show the same type of distribution. Differences in both artistic creation and appreciation are without doubt matters of degree; we all have these abilities.

Creative Expression and Esthetic Appreciation Are Not the Same.—A second conclusion that seems to arise from experimental studies is that creative expression and esthetic appreciation are quite different things. We may take the word of Eurich and Carroll[2] that there are no tests of creative ability that are satisfactory, but the use of such tests as are available point to the conclusion that one may be able to appreciate when he cannot create. Eurich and Carroll found a correlation coefficient of only .34 between the Meier-Seashore Art Judgment Test and the McAdory Art Test. They interpreted this low correlation as being due to the fact that the Meier-Seashore test tends to measure creative ability whereas the McAdory test is probably a measure of appreciation.

A fact related to this problem which seems to be fairly well established is that knowledge factors may have much

[1] Carroll, H. A., "A Standardized Test of Prose Appreciation for Senior High School Pupils," *Journal of Educational Psychology*, Vol. 23, pp. 401–410, 1932.

[2] Eurich, A. C., and H. A. Carroll, *Educational Psychology*, pp. 178 *ff*., D. C. Heath & Company, 1935.

less to do with some types of artistic expression than is commonly supposed. It is probable that this lack of relation holds more for the lower levels of artistic performance than for the higher levels, but it indicates that for the great mass of people the doors may be open to wide ranges of artistic experience even though there be little knowledge and mastery of conventional systems of artistic techniques. On the other hand, one may enjoy a broad knowledge of the field of art and not be gifted in artistic expression. Kwalwasser[1] found that Negro fifth-grade children at Gary, Ind., were inferior to white fifth-grade children in knowledge of musical notation but were superior in the actual use of notation in singing. The Negroes could sing but were apparently little concerned about the notation system. Evidences of this difference in knowledge about music and actual singing are reported by Salisbury.[2] Eight different tests of knowledge about the musical notation system showed (1) a fairly high degree of correlation (mostly in the range of .50 to .65), one test with another; (2) relatively low correlations (mostly in the range of .20 to .30) between these knowledge tests and sight singing; (3) a relatively low correlation (mostly in the range of .20 to .35) between these knowledge tests and the Seashore tests of Pitch and Tonal Memory. The Seashore tests probably represent fairly well native musical abilities and, in contrast to the knowledge tests, show a fairly high correlation, .60 and .64, respectively, with sight singing. To be sure, the sight singing of this experimental study was not of a high level, even though the subjects were high-school graduates; but the evidence, nevertheless, seems to point to basic differences in the relation of musical expression to factors of native ability and to knowledge about the notation system. These interpretations are in agree-

[1] Kwalwasser, Jacob, *Tests and Measurements in Music*, C. C. Birchard and Company, 1927.

[2] Salisbury, Frank S., "Is the Cart before the Horse in School Music?" *Journal of Educational Method*, pp. 90–96, November, 1931.

ment with Kwalwasser's report on the fifth-grade Negro and white children, and they are corroborated by the common experience of many a choir singer who cannot read musical notation but who has given creditable performances and got great satisfaction from singing. Indeed, what better evidence is needed than the improvised whistling of small boys and larger ones, melodies created by children in play, work songs and folk songs, all pointing to various types of artistic expression that are possible without a mastery of conventional systems of notation and techniques. In addition we may note the interest of thousands who enjoy the music of bands and orchestras, though they are not themselves musicians.

Esthetic Experience and General Intelligence.—Another line of evidence points to the fact that general intelligence has a minor bearing upon wide ranges of artistic experience. Here, again, it is well to hold in mind a reservation, namely, that the higher levels of artistic expression and appreciation may involve a combination of several abilities, one of which may be the abilities measured in tests of general intelligence. Salisbury[1] reports low correlations, ranging mostly between .20 and .30, between Part I of the Thorndike Examination for High-school Graduates and tests of knowledge of musical notation, as well as the Seashore tests of Pitch and Tonal Memory. General-information tests correlate much higher than this with general-intelligence tests. The low correlations of the Thorndike examination with the Seashore tests are evidence added to much like it in other fields, all pointing to the fact that human nature is organized with special abilities. Some of this added evidence follows.

Mechanical ability may rightly be included in the artistic range of experience; it involves many of the elements of art forms that are based on space relations, and inventiveness in this field is most certainly creative in the best sense of the word. Tests of mechanical ability, like

[1] *Ibid.*, p. 92.

those of musical ability, show low orders of relation with general-intelligence tests. Stenquist's[1] Test of Mechanical Ability shows low correlations with intelligence tests. The Stenquist tests are practical in their nature, many of them being the assembling of parts of machines, but they undoubtedly involve factors of space relation that are common to art expression. MacQuarrie's[2] Test of Mechanical Ability attempts to sample basic factors of mechanical ability through test items that involve space relations. The correlations of this test with tests of intelligence, like that of Stenquist are very low, none being above .20.

Speer[3] found very low correlations between mental ages of sixth-grade children and their scores on various tests of art judgment, including the Meier Art Judgment Test, the Christensen Test of Aesthetic Sensitivity, and the Christensen Pictorial Art Test. Speer also found that the correlation of mental ages with the scores on his Test of Recognition of Merit in Prose was but .39 and with those on his Test of Recognition of Merit in Poetry but .17. The interpretation of these coefficients is aided when they are compared with a coefficient of over .60 between mental ages and scores on the Gates Reading Tests. Judgment of merit in prose and poetry seems to be of an order of experience different from the interpretation of meaning from the printed page.

Carroll and Eurich[4] obtained results similar to those of Speer in correlating general intelligence and art judgment. With college students, they obtained correlations between the Miller Analogies Intelligence Test and the Meier-

[1] Stenquist, J. L., *Measurements of Mechanical Ability*, Bureau of Publications, Teachers College, Columbia University, 1923.

[2] MacQuarrie, T. M., "A Measure of Mechanical Ability," *Stanford University Abstracts of Dissertations*, Vol. 1, pp. 63–65, Stanford University Press, 1927.

[3] Speer, R. K., *Measurement of Appreciation in Poetry, Prose, and Art, and Studies of Appreciation*, pp. 50 *ff.*, Bureau of Publications, Teachers College, Columbia University, 1929.

[4] Carroll, H. A., and A. C. Eurich, "Abstract Intelligence and Art Appreciation," *Journal of Educational Psychology*, pp. 214–220, Vol. 23, 1932.

Seashore Art Judgment Test of .26, with the McAdory Art Test the correlation being but .10. Such low correlations indicate that similar degrees of abilities measured by intelligence tests and art tests may or may not exist in the same individual, making it quite impossible to predict ability in one from facts known about the other.

It is interesting to note, however, that comparison of scores of groups at different mental levels indicates that certain degrees of mental ability may be necessary to open the way to certain levels of the art abilities. Such might be the interpretation from the facts found by Carroll and Eurich in comparing the scores on the Miller Intelligence Test and the McAdory Art Test which had been given to a group of 43 superior junior-high-school students and to a group of 43 dull students who were paired for sex with the superior group. The group with the superior intelligence was, on the average, much superior to the dull group on the art test. The lowest score of the superior group was above the mean art score of the dull group. Only 9 of the 43 in the dull group exceeded the mean score of the bright group. Yet it is apparent from the distributions of the two groups that it is possible for dull students to get fairly high scores on the art test, but it is quite improbable that the superior students will get low scores on the art test.

A very significant study which has its practical bearing upon the everyday life of children in the home and at school is that of Huber[1] on the relation of reading interests of children and their intelligence. Children of three levels of mental ability, low, average, and superior, were asked to indicate their preference for one of many pairs of selections, both prose and verse, which were read to them. It was concluded that children do discriminate, that they have consistent preferences, and that this is quite as true of those at one level of intelligence as at another. The ability of the

[1] Huber, Miriam Blanton, *The Influence of Intelligence upon Children's Reading Interests*, Bureau of Publications, Teacher's College, Columbia University, 1928.

dull and the average was strikingly similar to that of the superior pupils in choosing good selections of various types of literature, except that dull children showed less appreciation for humorous selections and a greater preference for selections that represented familiar experience.

This study seems to join with many others in pointing to the general conclusion that esthetic interests and appreciations are not necessarily in accord with intellectual factors as measured by intelligence tests. It is to be expected that, in organizing the materials of the tests and experimental studies, intellectual factors may be inherent in the tests, and, if so, these factors will of course show in the results. On the whole, however, the surprising fact is that so many aspects of esthetic experience are open to many on the lower levels of intelligence, even though those of higher levels of intelligence are more apt to reveal higher levels of artistic ability.

Sex and Esthetic Experience.—It is a common observation that girls are more apt to be interested in art than are boys, and this is corroborated by test results. Carroll[1] tested 700 boys and 700 girls distributed over the junior- and senior-high-school and college levels, using the Carroll prose-appreciation test. Girls were found definitely superior in their ability to appreciate prose. In the top 10 per cent of the total high-school students, the girls outnumbered the boys 2 to 1, and on the college level there were 4 girls to each boy in the top 10 per cent. It is very probable that social pressure is responsible for at least part of this difference in the sexes, it being commonly accepted that literature and art are the business of the females of society, just as machinery and building are supposed to be the business of the males.

Social and Economic Background and Art.—Such evidence as is available seems to point in the direction of esthetic experience having little relation to social and

[1] Carroll, H. A., "Influence of the Sex Factor upon Appreciation of Literature," *School and Society*, Vol. 37, pp. 468–472, 1933.

economic background. Speer,[1] using the Sim's Score Card of Social-Economic Factors and the Burdick Test of Cultural Background, found low correlations between these measures of social and economic factors and various tests of art judgment and his tests of judgment of prose and poetry.

Summary: Educational Implications in a Study of Esthetic Experience and the Creative Life.—Our study of esthetic experience may be summarized in its relation to the implications for education as follows.

1. Art ability and esthetic judgment are distributed as are other abilities, with few at the two extremes and many in the middle ranges. Human nature gives no indication that geniuses are different from other people except as they have specialized to a high degree some innate ability, usually with the backing of high degrees of general ability and fortunate environment. Our educational programs should be organized on the assumption that art and the esthetic are native to human nature.

2. Art in its creation and in its use is normally related closely to the practical. It is a differentiation from this practical base; it enhances the useful and makes the useful more practical as it points the way to higher orders of experience. To the degree that the purpose of the school is to lead children to do better the things they will do anyway, art must be looked upon as an inherent part of the program. It will grow naturally out of real living and will contribute to the enrichment of it.

3. Artistic expression and esthetic appreciation have ever been conditioned by the presence of leisure. Today, when the wise use of leisure is a social and therefore an educational problem, we should look to the field of esthetic experience for the development of interests and understanding and appreciations which will carry through life and help make living an art through the constructive use of leisure. In this connection, it should be pointed out that many of us are cluttered up in our attitudes concerning

[1] Speer, *op. cit.*

matters of esthetic living and are unwittingly perpetuating systems of social pressure that close to developing children doors to the joys of music, poetry, artistic expression, and appreciation.

4. There is ample and convincing evidence in the everyday occurrences of life and in the results of experimental studies to warrant the conclusion that wide fields of

(*Courtesy of Los Angeles Public Schools.*)

Artists in Keeping with Their Traditions; There are Many and Varied Ways of Giving Expression to Artistic Impulse.

esthetic appreciation may be open to individuals who may not be able to go far in creditable artistic performance or in artistic creativeness. The geniuses are but few; the appreciators are many. There is need of developing modes of living in homes and in schoolrooms which will recognize these facts and make possible a wealth of satisfactions that are too commonly neglected. There should be opportunity for more individuals to develop artistic performance. There should be still more opportunity for all to appreciate. All should have the fun of trying their hands at creation,

for they will be more able to appreciate the work of others from such experiences.

5. There is sufficient evidence to make us wary of the assumption that the way to esthetic experience is through knowledge about our conventional systems of art techniques. These systems are products of long years of social evolution, they are abstractions and creations of a

(*Courtesy of Los Angeles Public Schools.*)

There Is fun and Satisfaction in Making Musical Instruments; New Interest in Other Kinds of Musical Experience Follows.

high order; they come from the top of human experience, and there is little reason for believing that they should offer to those at the bottom a natural approach to esthetic experience. The avenues of appreciation and participation undoubtedly offer the more fruitful and more natural approach which is open to the greater number. The race sang and danced long before it had a notational system.

6. It should be remembered that art is not bound closely to the great body of abilities that dominate school life. Art and the esthetic run relatively free; they are foot-

(*Courtesy of Los Angeles Public Schools.*)

Small Beginnings Should Be Encouraged; Young Children Need Freedom for Exploration and Opportunity for Expression.

loose and not too closely bound to the central and more general organizations of human nature. It is true that high degrees of esthetic experience generally rest upon relatively high degrees of general ability and upon a sound base of character and persistent effort from which the artistic ability has been differentiated. To the great masses of human beings, however, the doors may be opened to esthetic experience with little reference to general ability. Parents and teachers may expect artistic ability and esthetic judgment to appear in unusual places. Ability should be discovered, wherever it may be, and encouraged.

7. The esthetic life is rooted in basic emotional nature, and its development is in harmony with the development of the emotions. The esthetic life thrives in situations that are freed from emotional stress and strain; it is intuitive and rises from lower to higher levels when individuals are released from inhibitions. It follows that small beginnings must be nurtured with encouragement. Even in small beginnings some good may be found and induced to grow. Critical evaluations should be made only when a sound base has been laid in the beginner's own experience. The core of teaching method in the arts lies in encouragement, sympathy, and appreciation.

All in all, we need a renovation in our attitudes toward esthetic experience. Art is a part of life on all its levels, from the most practical to the highly differentiated creations of the artist who makes life richer for others. Art, because it is foot-loose in the organization of human nature, makes the life of individuals more varied.

SUGGESTIONS FOR NOTEBOOK AND BULLETIN BOARD

1. Organize illustrations to show the various ways in which modern society capitalizes the specialized artistic abilities of individuals.
2. Organize illustrations that show the three types of esthetic experience, namely, the creative, the artistic performance, and the appreciative.

3. Make a collection of evidences that show the natural relation between the useful and the artistic.

DIARY OF YOUR OBSERVATIONS

1. Make a record of observations that show the interest of very young children in esthetic and creative experiences.
2. Make a survey of your own special abilities that will indicate the possibilities of unusual development or the opposite. Indicate, for each of these, your attitude toward such experiences. Which of these are you actually developing? List cases of acquaintances who represent what you believe to be unusual native artistic ability that is not being developed.
3. An interesting experience for a group of students is to compare their own estimate of an ability basic to artistic performance with an actual measurement of such an ability. Let the members of such a group make an estimate of their ability in pitch discrimination, using grade points A, B, C, D, and E on a five-point scale or the estimate of their place in the rank order in the group. Let the group then take the Seashore test of Pitch and compare the scores with their estimates. The Seashore test of Tonal Memory might be used to give further evidence of basic ability in the field of music.

SUGGESTED READING

The following references are in the field of practical application of some of the general principles that seem to be warranted from our study of esthetic experience.

1. Coleman, Mrs. Satis, *Creative Music for Children*, (G. P. Putnam's Sons, 1922), has recorded her experience in organizing the activities of children in music on a natural basis. In general, the sequence of development which she found effective was that of rich, satisfying experience natural to the age of the children, with the techniques of the art entering as the needs and desires of the children called for them.
2. Caroline Seeds, in an article entitled "Rhythmic Expression," *Progressive Education*, Vol. 11, pp. 398–404, has described the way children enjoy working out rhythmic experiences to portray dramatically scenes that represent the things in which they are interested in their schoolwork.

3. Hughes Mearns, in *Creative Youth* (Doubleday, Doran and Company, 1925), has given a record of creative writing done by pupils of junior- and senior-high-school age. Mearns's work and companionship with these children are examples of creative living.
4. The development of the art program in our modern school systems tends to relate the art experiences with other work in which the children are greatly interested. Techniques are developed in connection with use, the essentials of the program being the interest that can be developed in art through its relation to other interests. Winslow, Leon L., *The Integrated School Art Program* (McGraw-Hill Book Company, Inc., 1939), is a typical reference in this field.
5. The student will profit greatly from reading the whole or from merely examining Hendrik Willem van Loon, *The Arts* (Simon & Schuster, Inc., 1937). On pp. 633–638 he gives his interpretation of how we may live with art to make life more worthy.

Chapter Eighteen

The Larger View

Throughout the preceding chapters, there has been a consistent point of view from which we have studied human nature. At all times, the question has been how the pattern of human behavior comes to be what it is and how this pattern changes as we learn through experience. We have found growth and development revealing a story of differentiation in which the simple organism of a single cell becomes complex through variation in the structure of cells as they multiply, some being organized for specialized activity of one kind and others serving in other ways within the organic unity. Through this process of differentiation, patterns of behavior are evolved, some patterns being basic to mere existence, others such as walking and talking being more general but typical of all human beings, and still others, perhaps, being peculiar to a single individual. Some of these patterns come to their fulfillment through growth and maturation, but learning quickly joins the growth processes in the creation of new patterns and the modification of old ones, all tending to bring the individual into fuller relations with his environment. Through the increase in complexity of these behavior patterns, mankind far outranks the other animals in adaptability.

Life Centers in the Relations between Organism and Environment.—Throughout this development, the inter-

relation of organism and environment remains the focal point of our inquiry. In the organization of the genes and chromosomes of germ cells we find the potential characteristics of the new individual, but this very organization within the germ cells is effected through interaction with environment. In the growth and development of the new individual, the environmental factors of life play an essential part. Continued life and development are conditional upon the maintenance of relations with the outer world of food and air and stimulus essential to cell activity. In this activity, the organism literally makes one with its environment. Haldane[1] has said, "Though we can distinguish them, we cannot separate them unaltered, and consequently cannot understand and investigate one apart from the other." The apparently simple process of breathing, for example, is found to be most complex, and we gain insight into this complexity only when we understand it as directed to the maintenance of the inner environment essential to cell life. Basic relations between the individual and the outside world are rooted deeply in patterns concerned with food, air, warmth, protection, and reproduction; here is the foundation of emotional behavior.

Rising from this base concerned with the essentials of life, the learning processes extend man's control to ever widening relations in an ever changing environment. Developing insight of the babe leads to the conscious understanding of childhood, and youth gains an increased sense of direction and purpose. During these years of development, the individual learns to direct and make use of his capacities for learning; his whole mental structure becomes organized for dealing with new issues of life. The learning processes follow the general plan of differentiation laid down in the growth processes. The most primitive forms of sensory presentations are patterned organizations, with the beginnings of insight and meaning arising from the patterning. The same principle holds for the thought

[1] Haldane, J. S., *Organism and Environment*, p. 99, Yale University Press, 1913.

processes, which are forever increasing in complexity but which balance complexity with the unifying processes of generalization in which the consistencies of varied experience are organized in the form of concepts, skills, habits, and interests. This process of generalization results in patterns that present both a subjective and an objective aspect. Our concepts of self are of a person that has relations with the outside world; our concepts of the outside world are of animate and inanimate things that mean something to us because they are relationally conceived. Our experience thus becomes dynamically organized in concepts, habits, attitudes, and interests that are inherently directed toward the maintenance and furtherance of relations with our environment.

In full harmony with the facts just reviewed, we have found the total organization of an individual, which we call personality, to be the natural product of this relational quality of life. Our personality becomes a reflection of our social experience, for it is through contacts with other individuals and through membership in social groups that we establish and maintain the avenues for self-expression and development. Personality is found to be essentially organic in its nature; the individual is essentially a differentiated social unit. We are born socially constituted; babes are dependent upon mothers for food and protection. We are born into membership of family groups; we develop and learn and become more intelligent human beings along with other human beings. Our lives and the integrity of our developing personalities are dependent at all points upon maintenance of these social relations. The organic principle of "All for one and one for all" seems universal in its application to human experience.

Culture and the Individual.—The environment into which we are born is in part that of nature, in part the result of man's control and exploitation of natural resources. Generation after generation has passed on its cultural heritage, each generation adding somewhat to the accumu-

lating whole, each revising and reorganizing this whole to suit the changing scheme of things, always attempting to increase human satisfaction and the certainties of life. Primitive mores and customs have been superseded by more purposeful lawmaking and organization of governmental control. The digging stick has been displaced by a crude plow and later by powerful machinery. The primitive use of fire and water by individuals has been displaced by the highly organized production of power for an industrial civilization.

The life of an individual, his very thoughts, and his developing personality are conditioned by these cultural forces which bear upon him directly and through social contacts. This man-made environment becomes a dominant factor in determining his experience. His civilization largely determines his concepts, attitudes, interests, life purposes, and ambitions. He is molded into the life about him. An individual raised in a savage tribe of head-hunters comes to view with pride his exploits of individual and group murder, but the same individual may be found showing the most sympathetic concern toward the welfare of his children, in this one respect possibly equaling his more civilized brother. Strange contradictions are found in both savage and civilized life, and the children of both grow up, molding their lives into an acceptance of inconsistencies and consistencies alike.

The Problem of Emotional Control.—As we have viewed the problem of contradictions in our study of emotional behavior, the issue has been found to rest in bringing into accord man's inherited emotional nature and the intelligent superstructure from which his complex modern life has evolved. Survival in ancient times went to those who feared and those who fought savagely, and these inborn tendencies seem to persist in successive generations. If man is not at war with other nations, he finds the occasion for conflict within the closer limits of his family, community, or natural life.

Turning to the front page of a newspaper, one finds ample evidence both of complexity of social relations and of conflict growing out of the limitations of social organization. The major headline is, "600,000 Wait Strike Order." This is followed by subtitles: "Labor chiefs ready to flash word. Peace negotiations collapse. President is keeping close watch. Operators to fight." This news takes but slight precedence over a report of a foreign country that is bent on extending its power to a neighboring state. In another column, we learn that a minor-party candidate has captured a major-party nomination. In another space, a double-column editorial has been brought forward to the front page under the title of "A Moral Issue" and tells of the apprehension arising from the possible mixing of political motives and relief to a stricken area.

Shorter items on this front page continue as follows. A 10 per cent cut in salaries of officers of a large corporation is expected. A European government hangs an insurgent allied with a movement in another country. A national farmers' organization protests against the rising prices of industrial products. A dog sails first class, with the owner in the steerage. A man shoots and kills another who is stealing his chickens. A high United States official severs his relation with his state political organization. A fifteen-year-old girl intercedes in a brutal quarrel in which her father is beating her mother; she shoots her father, and the bullet continues on and takes the life of her mother. Down in the corner of this front page is the report of a college professor who is telling teachers that we need schools in which children learn the meaning of cooperation by living and working together instead of being continually stimulated to rivalry and competition.

The individual personality seems lost in this maelstrom of forces and counterforces. His life course seems determined by the cultural stream which hems him in from without, but he seems limited and hampered by inherited emotional tendencies which are out of harmony with the

cultural stream. Yet these forces and limitations but set the stage for life, however difficult a problem of adjustment they may raise. The freedom of the individual and the solution of his problems lie in the quality and nature of the mental processes that have evolved his civilization. The solution of large and small problems alike is dependent upon the thought processes which sort the consistencies from the inconsistencies, thereby raising the issue to a level on which the generalizations that have emerged from past experience unite with present experience to give insight and understanding. The capacity for abstraction, which is at the root of the thought processes, is instrumental in pulling us away from the immediacies of our problems to give us perspective. It is this capacity for perspective that makes possible the saving sense of humor that noses out the incongruous in experience and sets the stage for an alliance of intelligent foresight and emotional drive for the common purpose of making the most out of life.

An Example of the Larger View.—This interpretation of mankind's control of his life through intelligence may seem too abstract to bear the weight of practical application in our lives. Such, however, is not the case. The process of objectifying our problems is as universal in our experience as are the basic emotional patterns; ultimately, emotional behavior tends to an alliance with intelligent thought and action. Let us cite an example to show that this is the common order of our lives. Cyclones are seemingly quite beyond the control of man, but note the character of control exercised in relation to this destructive natural force. In the parts of the world where cyclones are common, man is forehanded and builds cellars for his protection. With a cyclone approaching, he tries to reach this refuge; and, if this is impossible, he lies flat on the ground to escape as much as possible the force of the wind. To be sure, he is frightened, but it is an intelligent fright. Even under the influence of justifiable fear, he may be estimating the possible extent of the damage done, the amount

of insurance that he may be paid, and how he shall go about the restoration of his property. His thoughts may easily become concerned with the fortunes of his friends and neighbors. Furthermore, we may find him bolstering his morale through an abstraction and objectification of his problem as he reasons that it is "just as well to be calm and use one's head, particularly in such trying circumstances." Besides this, we may find a final touch of abstraction in his faith in a higher being, this faith having come in the course of long generations of evolution from a religion of fear and propitiation to one of love which adds to his overview of life's problems.

Similar dramatic stories are to be found in man's conquest of space and time through the development of transportation and communication. These conquests are the products of his thought and of his developing interests in new fields of endeavor; they change the whole face of his environment and thus create the necessity for more thought and more social organization. Through the conquests of time and space, he makes the people of other continents his neighbors and brings the world together into a new unity, a unity of increased complexity which in these days is reflected in new world problems of industry and trade, of government, and of international relations.

Personality Persists as a Central Issue in Social Change. Whether viewed historically or in a survey of the present scene, concern with individual personality is to be found at the center of social changes. This is plainly seen in the development of governmental systems in which the trend has been toward greater recognition of the welfare of the individual. The problem of social change may be viewed as political, or as social, or as economic and industrial; but, ultimately, human nature becomes a central issue in the adaptations to be made. The issue persistently reverts to the question of whether man can cooperate with his fellow man in an organized society. Psychologically, the issue rests upon whether his emotional and intelligent

natures can be induced into a cooperative unity in social living. In the solution of these problems, his understanding of his own nature is quite as essential as his appraisal of the outer conditions that confront him. The solution calls for an understanding of the basic relation of emotional control and social cooperation. There is need of social inventiveness which will evolve methods of cooperative relations. There is need of organizing the control of the swiftly developing material culture that has rolled up in massive proportions and swamped man with the social problems which it has brought with it. There is always the need of organizing not only the life within but also the circumstances of life in our environment.

Implications for Education.—Certainly the education of children in the home and school is at the heart of any constructive attack upon such a problem. There is need of educational procedures based upon greater respect for the personality and individuality of developing children. There is need of greater freedom in which individual children have an opportunity to develop. This freedom will be balanced by individual responsibility and by the discipline which is inherent in purposeful group cooperation.

In this period of rapid social change, the question of how children learn becomes fully as important as what they learn. The problems raised today for adults to meet may possibly continue as the problems of the oncoming generation, but they may be easily overshadowed by new and unforeseen issues. The youth of today is caught in the grip of changing circumstances in the making of which he has had no responsibility. The best heritage that the present generation can give him is a clear understanding of the dynamic forces that cause our cultural changes and an early start in dealing with these problems as realities. In the course of such practical experience, he may develop attitudes and interests that are rooted in group living and are pointed to the problem of social cooperation and organization. Youth must be schooled in courage and morale

of a highly intelligent order if new methods of cooperative social control are to be evolved to meet the growing need. Such a program implies the breaking of old norms of thought and the development of attitudes of open-mindedness toward change, for change is the most certain factor in this growing complexity.

Both the social and the psychological aspect of these issues will be respected in the life of a schoolroom that makes one with the life outside. The fundamentals of this new education become social living, facing the real problems of life, facing them with the enthusiasm that comes from the reality of the issues. The tools of education, which too often have been considered the fundamentals, must give way to these vital issues; they will gain instead of lose as they become means to these more vital ends of living. In such a program, we find our knowledge of human nature uniting with our current philosophy of education and with the example of successful practice in our best schools, all asserting in harmony that we learn through experience and that learning involves the whole of life.

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